SkyAzúl
EQUIPMENT SOLUTIONS

Mark 4K

SERVICE MANUAL

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1. Introduction

1.1 Foreword

If the system or operator control errors occur during operation of the load moment indicator (LMI), these are indicated by overlaid error windows. It is possible for up to “8” errors can be displayed at the same time. To scroll through all errors indicated up or down buttons.

Operator errors are displayed as plain-text messages, and all other errors by a “4” character numeric code. The exceptions are the hardware faults for cable break and cable short circuit in the sensor system, which are displayed as plain-text messages.

Those errors displayed in the form of code numbers will generally be hardware faults, software errors or else programming errors in Data-Eproms. They can, for example be cause by defective components, incorrectly programmed memory chips, etc. Operator errors and faults that may occur, and provides information on how to correct them.

Note!

Faults that are not operator will always require the services of an authorized service provider. Error correction and troubleshooting will necessitate having the up-to-date circuit diagrams and associated connection diagrams in hand.

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1.0 MECHANICAL DESCRIPTION OF THE COMPONENTS

1.1 Pressure Transducer: The pressure transducer transforms hydraulic pressure into an electric analogue voltage signal. Two pressure transducers are connected, one to the rod side and one to the piston side of the lift cylinder. The pressure transducer is connected to the central unit with a four conductor, double shielded cable.
The power supply voltage is +12V.
The output signal is 2.500V at 0 pressure to 7.500V at maximum pressure (250bar).

1.2 Cable Reel: The cable reel houses the length-angle transducer, slip ring disc and slip ring pick up (to feed and return A-2-B signal). The PE cable goes through the drum and out to the tip where it is wired to the Anti-Two-Block switch. The reel is driven by a tensioned spring and should be handled with caution.

1.3 The Length-Angle Transducer: The length-angle sensor (LWG) is a combination of two transducers in cable reel, fitted at the base section of the boom. It measures the length and the angle of the boom.
A reeling drum drives a potentiometer, which is the length transducer. Part of the length transducer is the length cable on the drum, which is a two-conductor cable (shield and core). It is connected to the anti-two-block switch at the boom head and to a slip ring body in the LWG. The angle transducer is fitted in the cable reel. A pendulum drives the axle of the angle potentiometer.
The power supply voltage for both is +5.00V
The output signal for the length transducer is: +1.000V up to +4.500V
The output signal for the angle transducer is: +1.000V up to +4.500V

1.4 Anti-Two-Block Switch: The anti-two-block switch monitors the load block and it's relationship with the head of the boom. In working condition the switch is closed. When the hook block strikes the weight the circuit opens, disengaging a relay output to the lock out solenoid valves, where applicable. The weight at the anti-two-block switch keeps the switch closed until the hook block strikes it.

1.5 Console: The console displays all geometrical information such as length and angle of main boom and working radius. It also displays the actual load and the maximum load permitted by load chart. Furthermore it has an alarm horn and a warning light for overload, and a pre-warning light. The bar graph with green, yellow and red indicator bar shows a percentage of the total permissible moment. The console has pushbuttons to switch the operating modes (for selection of crane configurations and reeving of the block). It also has a warning light for overload, anti-two-block conditions and an override push button for anti-block condition.

2.0 MECHANICAL AND ELECTRICAL DESCRIPTION OF THE CENTRAL UNIT

All the data's of the crane are stored inside the central unit in E-Proms. The central unit gets all actual information of the crane. This is computed against the reference data and the crane status continually monitored.

2.1 Description of the Housing: The central unit Mark 4k has a waterproof aluminum housing. It is mounted in the cab. The cables are led into the central unit via strain reliefs and connected with fast-ons. On the housing is mounted an override switch to override the LMI function. The system is protected by a 2 AMP fuse which is mounted on the lower right side.

2.2 Description of the Boards: Inside the central unit there is one board. The main board that has terminal strips where power and various components are connected with fast-ons to the terminal strip. The main board is the heart of the system. It contains the main computer and the necessary electronics to receive, evaluate, process and direct the continuous data. There are overload and anti-two-block relays, which control the bosch relay for lever lockout, also mounted on this board.

A 24/12-volt converter, (for 24 volt cranes) which converts 24 volts to 12 volts on the main board.
An analogue input part, which receives and prepares all the signals from the transducers for further processing.
An analogue/digital converter part, which converts all the processed analogue signals into digital ones.
A digital part, which contains the main computer and the ancillary electronics.

2.3 Incoming Signals: The signals from the transducers are connected to the terminal board. The signals of the angle-length transducer are connected to terminal #56 (angle). The signal on terminal #56 (ANGLE) is between approximately +1.000V and +4.500V. The signals from the load pin are connected to terminal #51 (DMS). The signals on terminals #51 range between +2.500V and +7.500V.

2.4 Outgoing Signal: The outgoing signal of the terminal board is the signal for lever lockout of
Terminal #87 on the Bosch relay. In normal working conditions there are 12 or 24 volts at this terminal. When there is an overload or anti-two-block condition the signal becomes 0 volts. Furthermore all voltages for the transducers and console are going out via the terminal strip.

3.0 BASIC ADJUSTMENT OF THE HARDWARE

3.1 **Length:** Ensure that the length cable tension is correct with fully retracted boom by turning the cable reel 2 to 3 turns counterclockwise and check that reel fully retracts. Then remove cover form cable reel and adjust arm mounted on the potentiometer till length indication is correct.

3.2 **Angle:** Set the boom to 0 degrees and set a digital level on the boom. Adjust the angle sensor to the same angle as the boom. Check the angle at 20 degrees, 45 degrees, 70 degrees. Angle display should be less than ± .5 degrees of the value of the inclinometer.

3.3 **Pressure Channel**: Rest the boom and disconnect the pressure transducers. Measure the voltage of both pressure transducers on the terminal board. The output voltage of the pressure transducers should be 2.500vdc +/- .025vdc.

3.4 Check the function of the hoist limit switch (anti-two-block)

3.5 Check function of lever lockout.

3.6 Measure and record the power supply voltages.

SECTION 1. DEFINITIONS

1. BOOM LENGTH The straight line thru the centerline of boom pivot pin to the centerline of the boom point load hoist sheave pin measured along the longitudinal axis of the boom. (Indicator ± 2%).

2. BOOM ANGLE The angle between the longitudinal centerline of the boom base section and the horizontal plane. (Indicator 65° to 90° boom angle + 0°/2°; less than 65° boom angle + 0°/-3°)

3. RADIUS OF LOAD The horizontal distance from a vertical projection of the crane's axis of rotation to the supporting surface, before loading, to the center of the vertical hoist line or tackle with rated load applied. (Indicator 100% to 110%).

4. RATED LOAD The load value shown on the applicable load ratings chart of the crane for the particular crane configuration, boom length, boom angle, or functions or these variables. For radii outside those shown on the load ratings chart, the rated load is to be considered as zero.

5. ACTUAL LOAD The weight of the load being lifted and all additional equipment such as blocks, slings, sensors, etc. Also referred to as working load. (Indicator 100% to 110%).

6. CRANE CONFIGURATION The physical arrangement of the crane as prepared for a particular operation in conformance with the manufacturer's operating instructions and load rating chart.

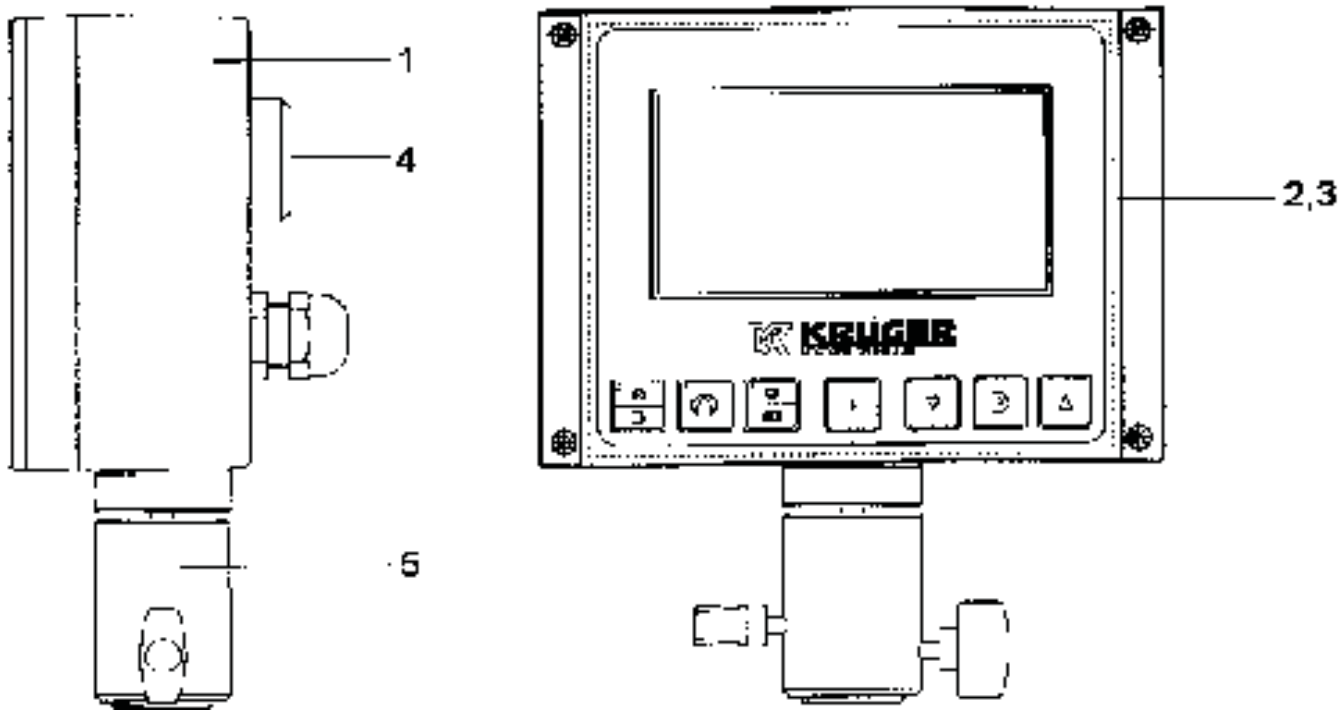
7. TWO-BLOCKING Contact of the lower load block or hook with the upper load block, boom point, or boom point machinery.

8. ANALOGUE Electrical signals that vary in proportion to the quantities they represent. (Boom length, angle, and pressure transducer).

9. DIGITAL Electrical signals of an on and off state (two different voltage levels) to represent some quantity of operation. (A2B, area definition switch).

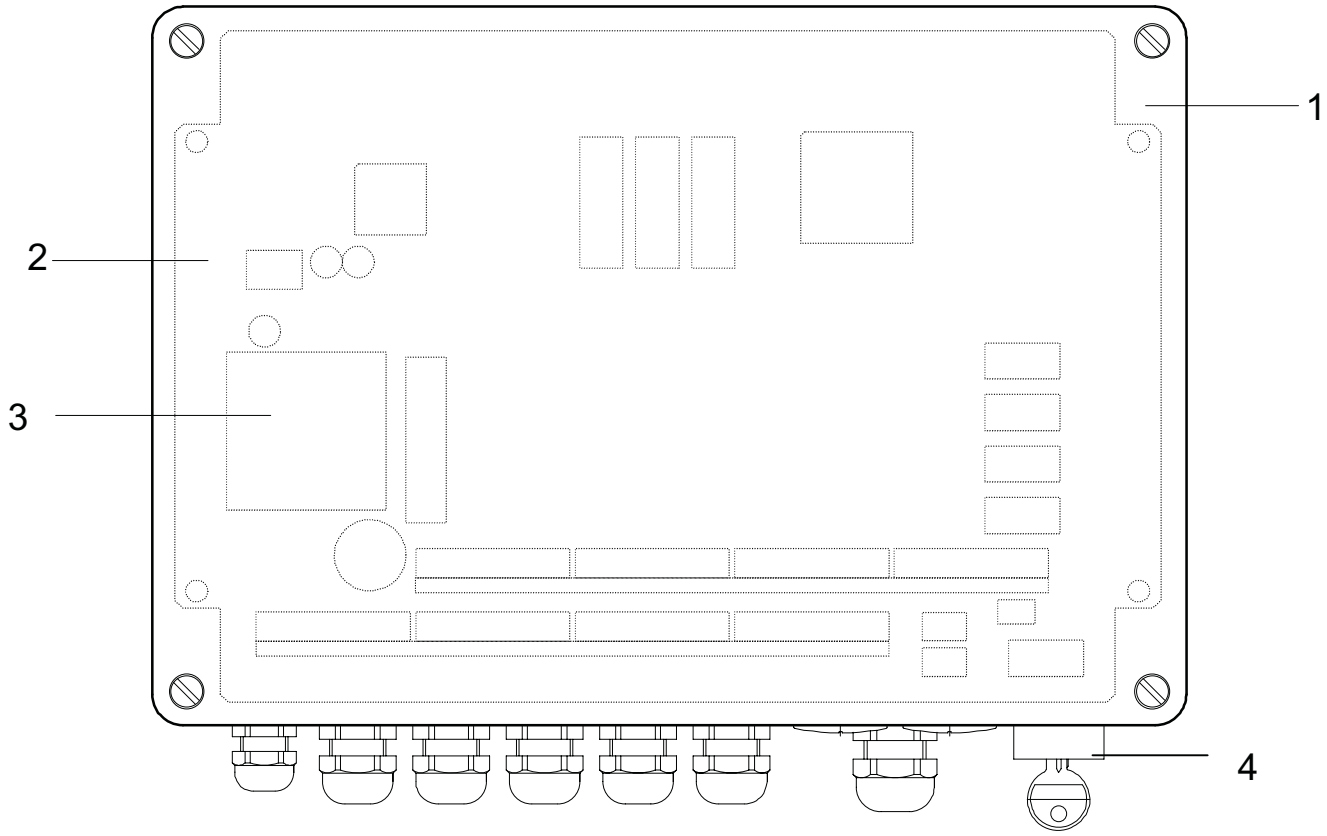
SECTION 2. DRAWINGS

DRAWING 1. INDICATOR PANEL MARK 4K 1-0112197.00 Spare Parts List



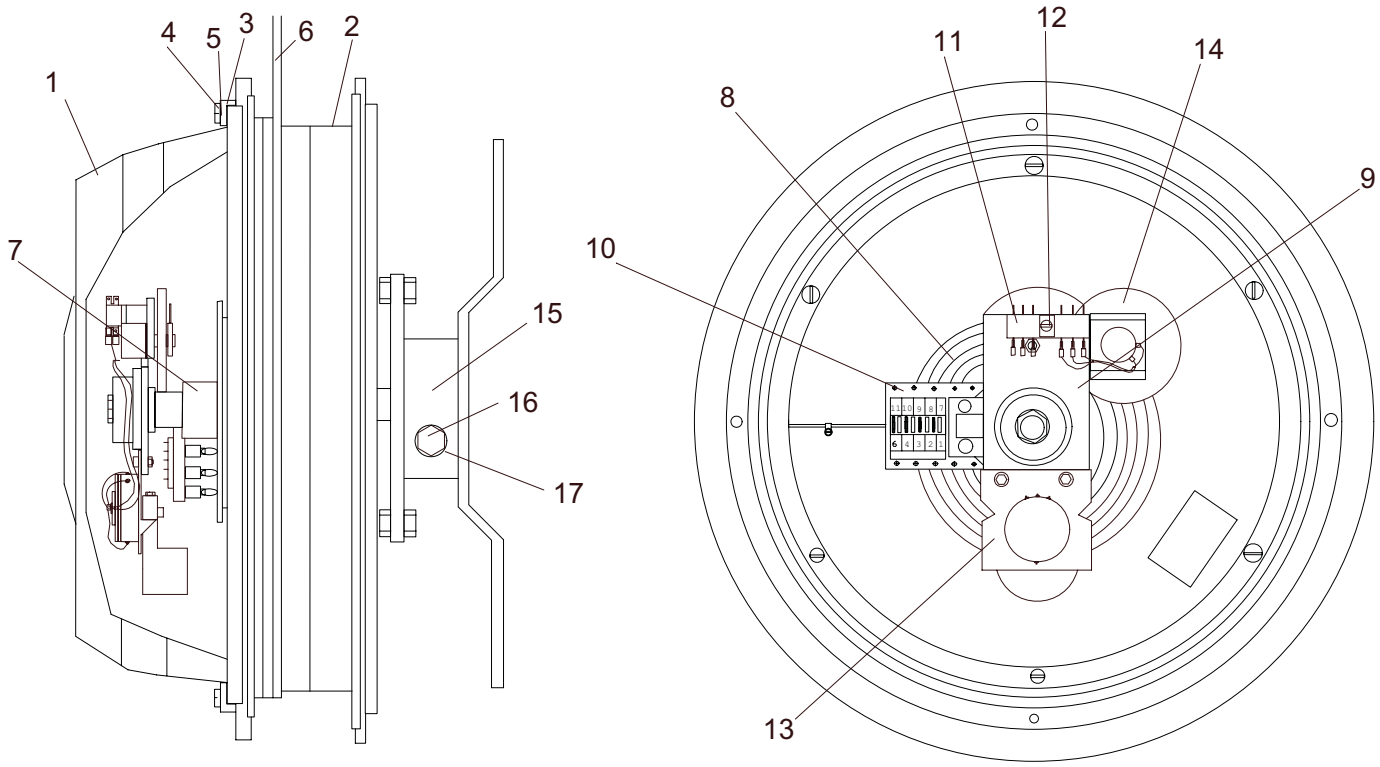
ITEM NUMBER	DESCRIPTION	QUANTITY	ARTICLE NUMBER
1	Housing	1	1-0113148.00
2	Module (LC-Display)	1	1-0112196.00
3	P. C. Board	1	1-0010752.00
4	Electronic Beeper	1	1-0112135.00
5	Mount	1	1-0112176.00
Supplies:	Connecting Cable	1	1-0112843.00

DRAWING 2. CENTRAL PROCESSOR 24VDC - MARK 4K 1-0112757.00 Spare Parts List



ITEM NUMBER	DESCRIPTION	QUANTITY	ARTICLE NUMBER
1	Housing	1	1-0103719.00
2	P.C. Board (Central Processor)	1	1-0112111.00
3	Module (DC/DC Converter)	1	1-0028174.00
4	Key Switch	1	1-0103247.00

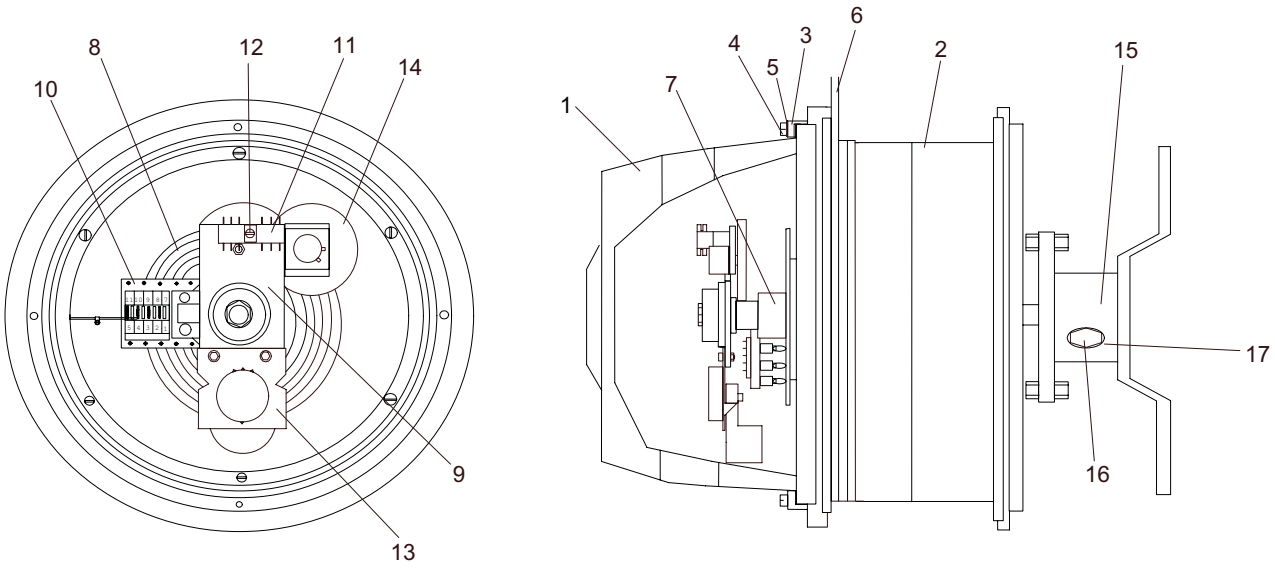
DRAWING 3. Cable Reel 34/50 m 1-0115468.00 Spare Parts List



ITEM NUMBER	DESCRIPTION	QUANTITY	ARTICLE NUMBER
1	Cover Complete	1	1-0016897.00
	- Cover	1	1-0010159.00
	- Rubber Seal	1	1-0010631.00
2	Cable Reel Body	1	1-0010653.00
3	Angle Clamp	4	1-0010613.00
4	Slotted Flat Head Screw - M5 x 14	4	1-0012350.00
5	Nylon Washer - M5	4	1-0010581.00
6	Shielded Cable 1x1	45M	1-0102079.00
7	Receiver	1	1-0010615.00
8	Slip Ring Disk	1	1-0021448.00
9	Angle Bracket	1	1-0010175.00
10	Contact Holding Plate	1	1-0116041.00
11	Terminal Strip	1	1-0011684.00
12	Slotted Flat Head Screw - M4 x 10	1	1-0010582.00
13	Angle Transducer Complete	1	1-0015264.00
	- Mounting Plate	1	1-0010626.00
	- Pot	1	1-0012157.00
	- Pendulum	1	1-0010628.00

14	Gear Drive Complete	1	1-0021212.00
	- Pot	1	1-0013697.00
15	Mounting Bracket	1	1-0027856.00
16	Hex Head Cap screw - M10 x 45	1	1-0012207.00
17	Lock Washer - M10	1	1-0010096.00

DRAWING 4. Cable Reel 24/30 m 1-0115463.00 Spare parts List

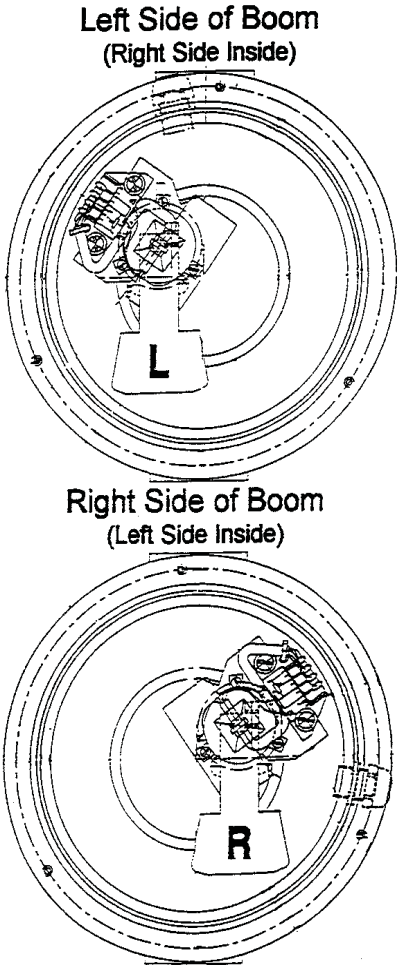


ITEM NUMBER	DESCRIPTION	QUANTITY	ARTICLE NUMBER
1	Cover Complete	1	1-0107886.00
2	Cable Reel Body	1	1-0107885.00
3	Angle Clamp	4	1-0010613.00
4	Slotted Flat Head Screw - M5 x 14	4	1-0012350.00
5	Nylon Washer - M5	4	1-0010581.00
6	Shielded Cable 1x1	30M	1-0102079.00
7	Receiver	1	1-0010615.00
8	Slip Ring Disk	1	1-0021448.00
9	Angle Bracket	1	1-0010175.00
10	Contact Holding Plate	1	1-0116041.00
11	Terminal Strip	1	1-0011684.00
12	Slotted Flat Head Screw - M4 x 10	1	1-0010582.00
13	Angle Transducer Complete	1	1-0015264.00
	- Mounting Plate	1	1-0010626.00
	- Pot	1	1-0012157.00
	- Pendulum	1	1-0010628.00
14	Gear Drive Complete	1	1-0021212.00
	- Pot	1	1-0013697.00
15	Mounting Bracket	1	1-0027856.00
16	Hex Head Cap screw - M10 x 45	1	1-0012207.00
17	Lock Washer - M10	1	1-0010096.00

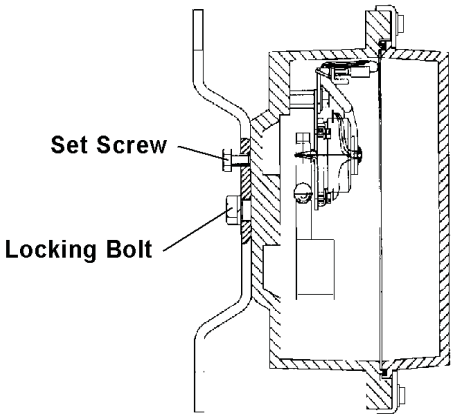
DRAWING 5. Angle Sensor WG203 Adjustment 1-0115294.00

The angle ϕ shown in drawing below 1 needs to be within +0, -0.4 of the actual angle of the boom. Check boom angle at base/heel Section only. After adjustment, compare the actual boom angle with the displayed angle at about 0°, 30° and 60°. To comply with the SAE J375 standards the displayed angle must be +0.0° to -2.0° of the actual angle.

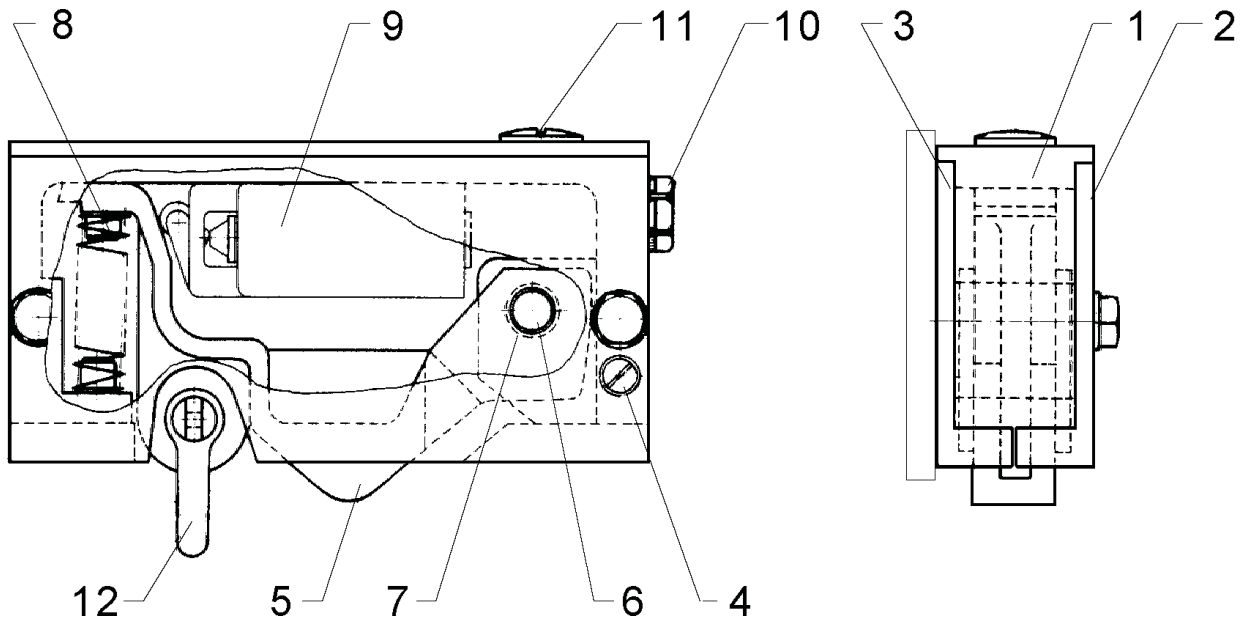
Angle Transducer Pendulum Stop Set



Angle Transducer

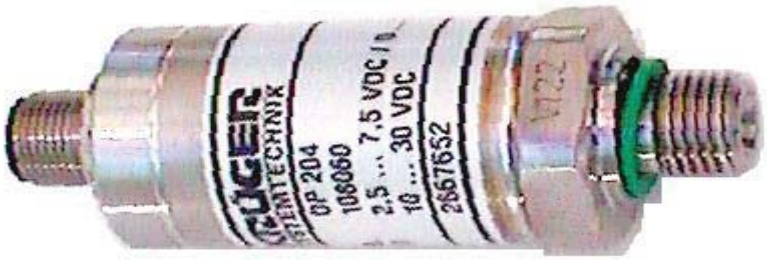


DRAWING 6. Anti-Two Block Switch 1-0024849.00



ITEM NUMBER	DESCRIPTION	QUANTITY	ARTICLE NUMBER
1	Center Housing	1	1-0112531.00
2	Cover - Left	1	1-0010045.00
3	Cover – Right	1	1-0010044.00
4	Slotted Flat Head Screw - M5 x 8	2	1-0013391.00
5	Lever	1	1-0010041.00
6	Straight Pin	1	1-0010042.00
7	Bushing	1	1-0010104.00
8	Spring	1	1-0100326.00
9	Micro Switch	1	1-0010039.00
10	Cable Connector	1	1-0010037.00
11	Blind Plug	1	1-0010038.00
12	Shackle with Cotter Pin	1	1-0009999.00
Required for Mounting - Order Separately			
	Weld Plate	1	1-0010046.00
	Hex Head Cap screw - M8 x 50	2	1-0010083.00
	Lock Washer - M8	2	1-0010097.00

DRAWING 7. Pressure Transducer (250 BAR) 1-0108060.00

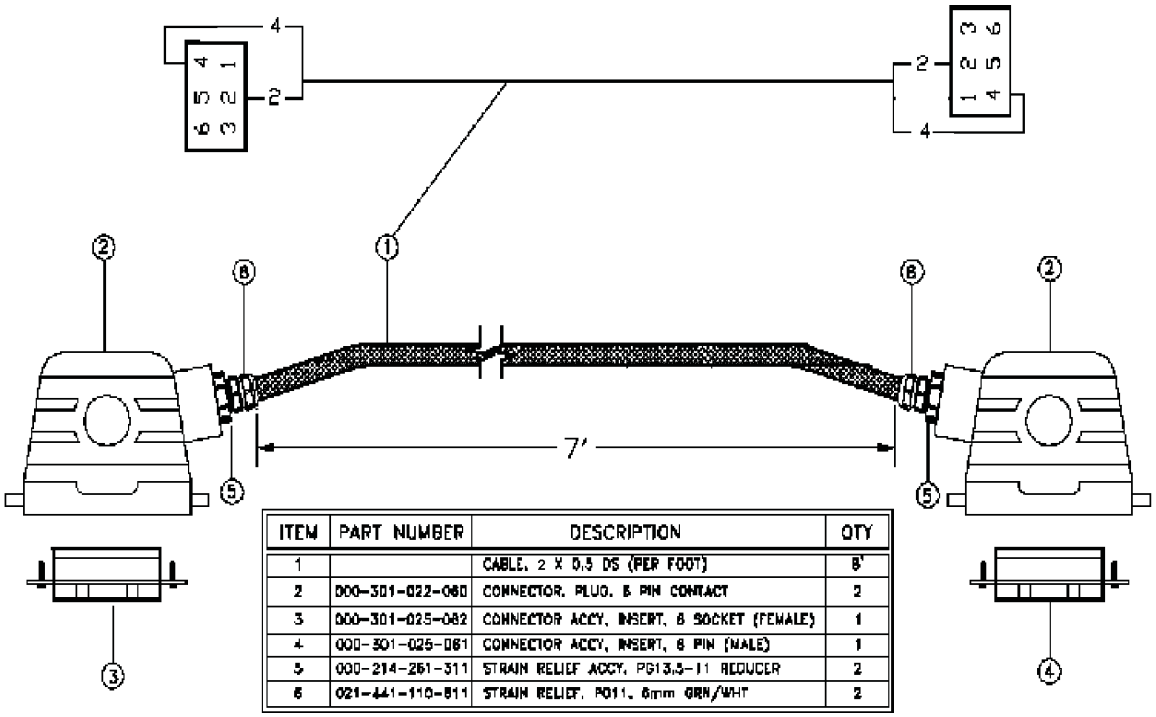


DRAWING 8. Pressure Transducer Cable Assembly

(Part Number is depends cable length)

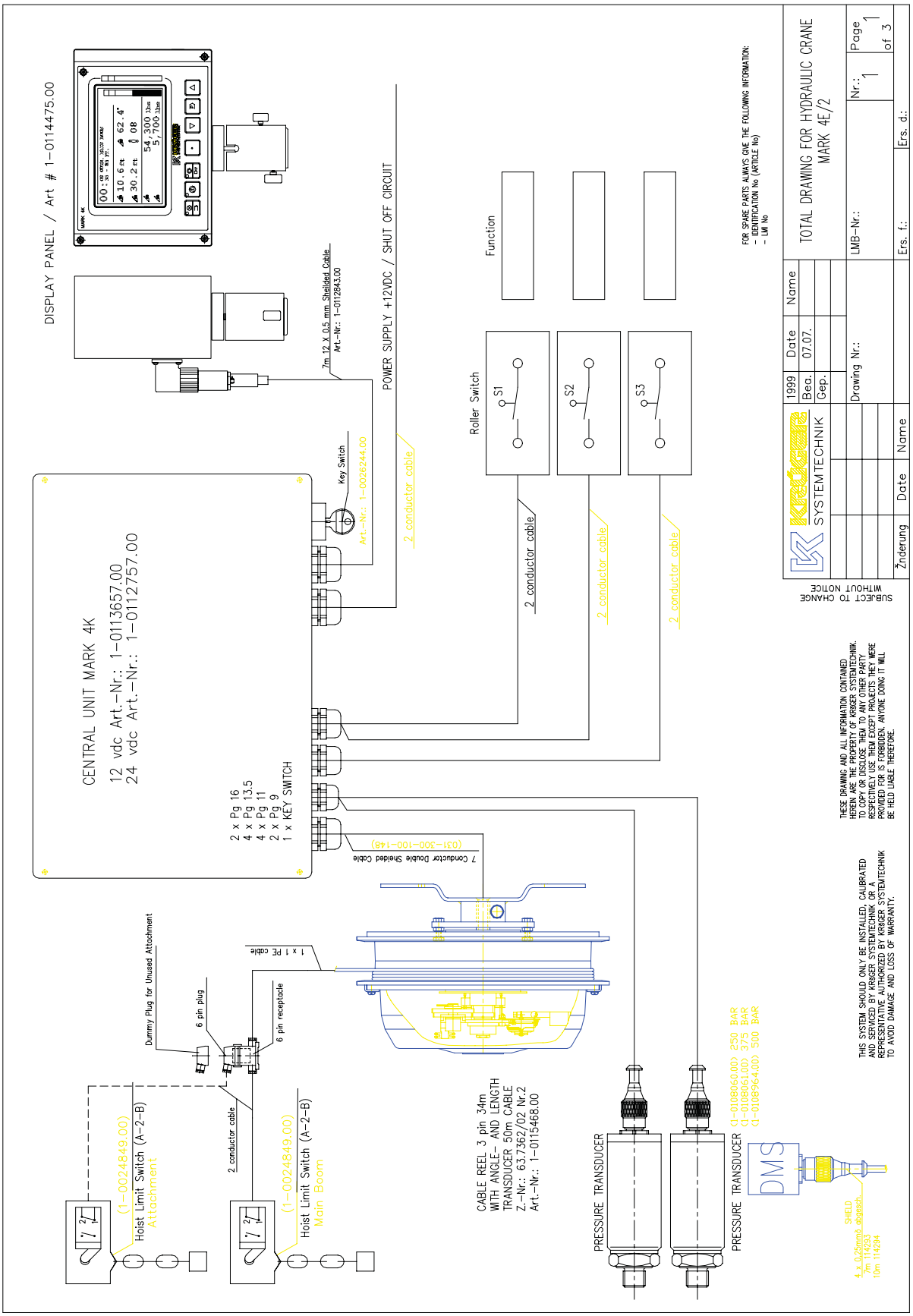
Connector Cable - Straight x 7M.	1-0114293.00
Connector Cable - Straight x 10M.	1-0114294.00
Connector Cable - 90^0 Connector	1-0101758.00

DRAWING 9. Jumper Cable Assembly for Extension 350-5004



ITEM	PART NUMBER	DESCRIPTION	QTY
1		CABLE, 2 X 0.5 DS (PER FOOT)	8'
2	000-301-022-060	CONNECTOR, PLUG, 6 PIN CONTACT	2
3	000-301-025-062	CONNECTOR ACCY, INSERT, 6 SOCKET (FEMALE)	1
4	000-301-025-061	CONNECTOR ACCY, INSERT, 6 PIN (MALE)	1
5	000-214-251-311	STRAIN RELIEF ACCY, PG13.5-11 REDUCER	2
6	021-441-110-811	STRAIN RELIEF, PG11, 6mm GRN/WHT	2

DRAWING 10. Wiring Diagram – Basic w/parts


DISPLAY PANEL / Art # 1-0114475.00
7m 12 X 0.5 mm Shielded Cable
Art.-Nr.: 1-0112843.00
POWER SUPPLY +12VDC / SHUT OFF CIRCUIT
Function
Roller Switch
S1
S2
S3
Key Switch
Art.-Nr.: 1-0026244.00
2 conductor cable
CENTRAL UNIT MARK 4K
12 vdc Art.-Nr.: 1-0113657.00
24 vdc Art.-Nr.: 1-0112757.00
2 x Pg 16
4 x Pg 13.5
4 x Pg 11
2 x Pg 9
1 x KEY SWITCH
7 Conductor Double Shielded Cable
(031-300-100-148)
1 x 1 PE cable
Dummy Plug for Unused Attachment
6 pin plug
6 pin receptacle
2 conductor cable
(1-0024849.00)
Hoist Limit Switch (A-2-B)
Attachment
Main Boom
CABLE REEL 3 pin 34m
WITH ANGLE- AND LENGTH
TRANSDUCER 50m CABLE
Z.-Nr.: 63.7362/02 Nr.2
Art.-Nr.: 1-0115468.00
PRESSURE TRANSDUCER
(1-0108640.00) 250 BAR
(1-0108641.00) 375 BAR
(1-0108964.00) 500 BAR
DMS
SHIELD
4 x 0,25mm²
7m 114293
10m 114294
FOR SPARE PARTS ALWAYS GIVE THE FOLLOWING INFORMATION:
- DESTINATION No (ARTICLE No)
- LMI No
SUBJECT TO CHANGE WITHOUT NOTICE
Änderung Date Name
SYSTEMTECHNIK
1999 Date Name
Bea. 07.07.
Gep.
Drawing Nr.:
TOTAL DRAWING FOR HYDRAULIC CRANE
MARK 4E/2
LMB-Nr.:
Nr.: 1
Page 1 of 3
Ers. f.: Ers. d.:
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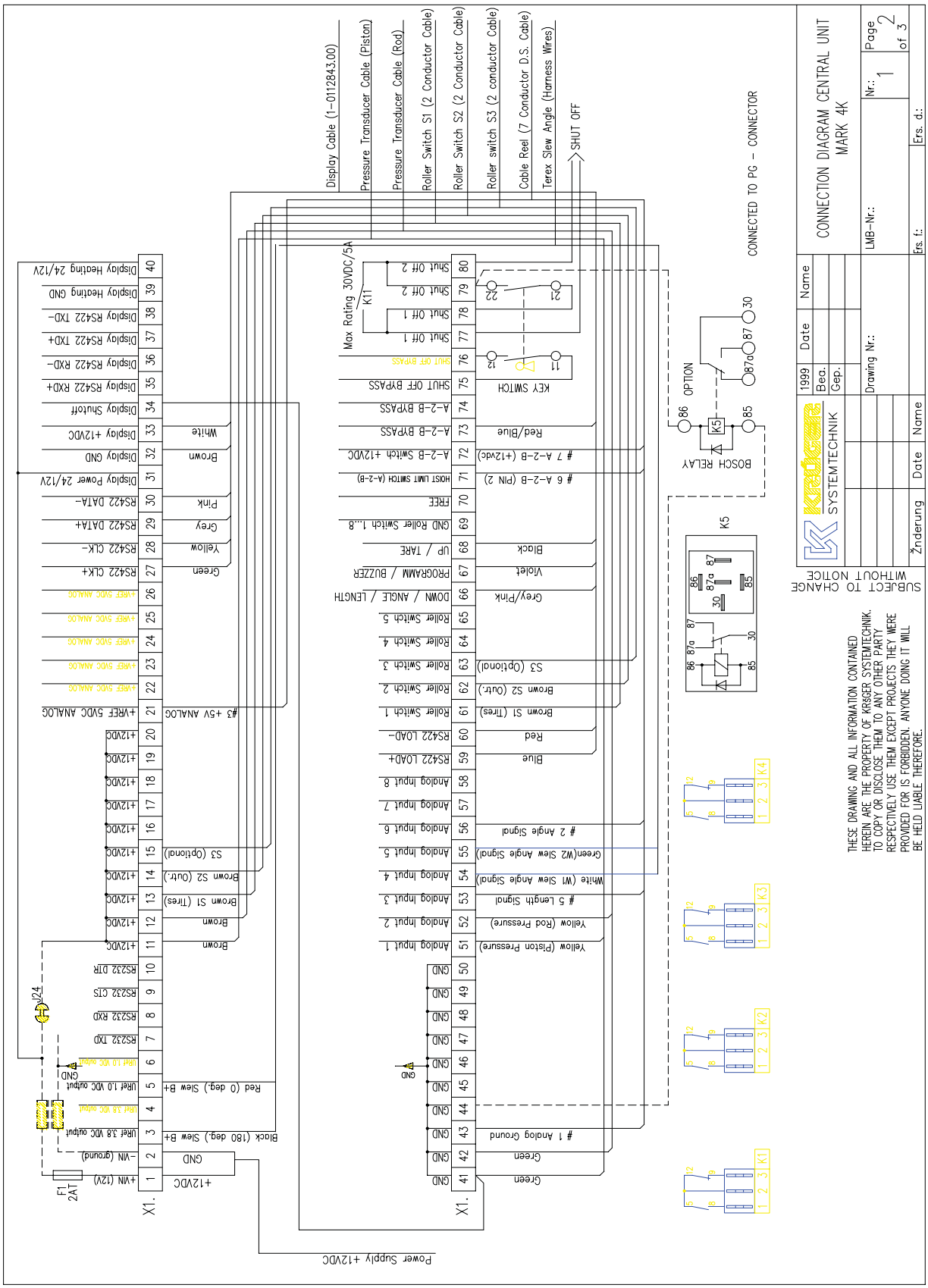
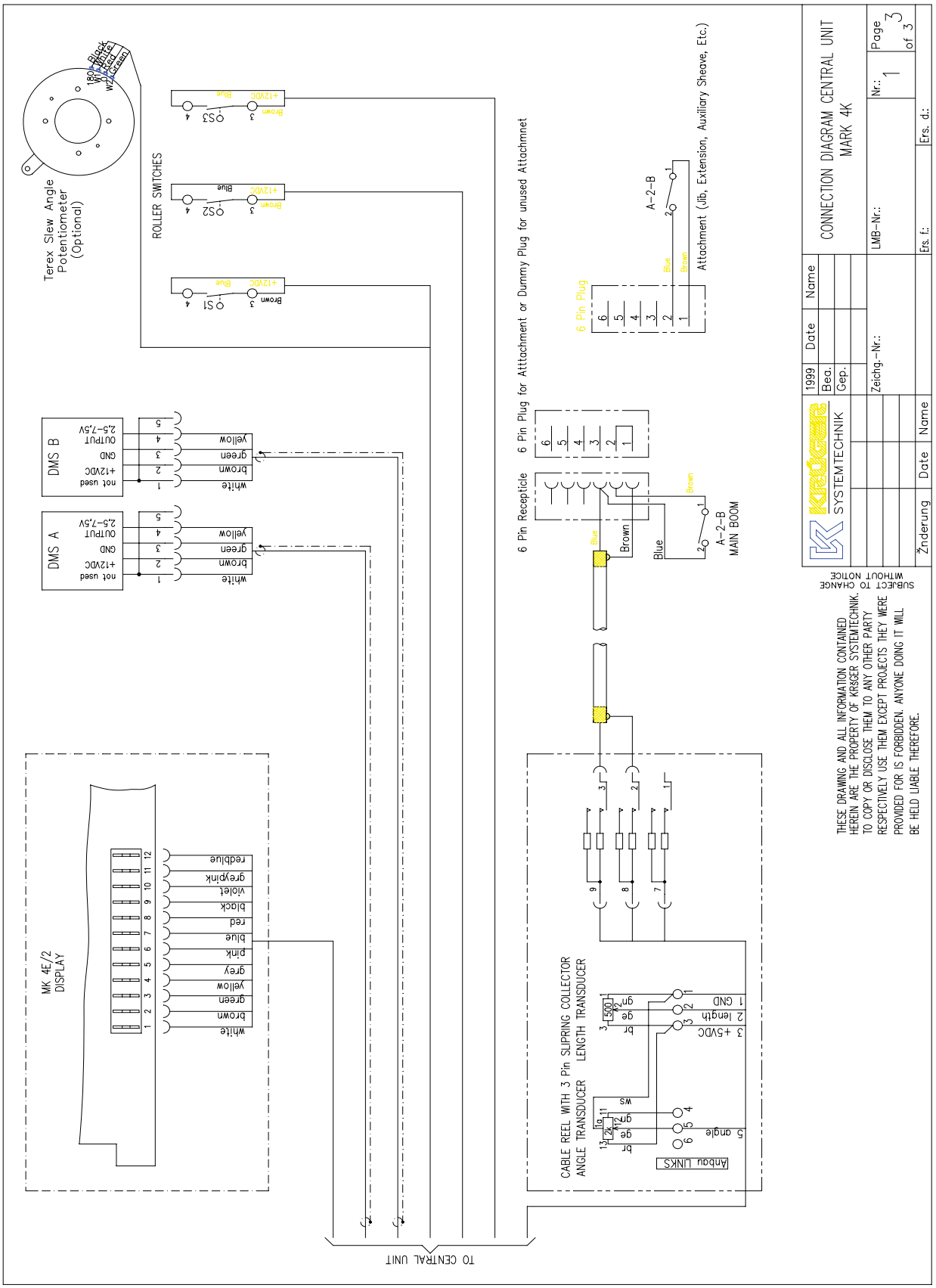
DRAWING 11. Wiring Diagram – Central Unit Connections



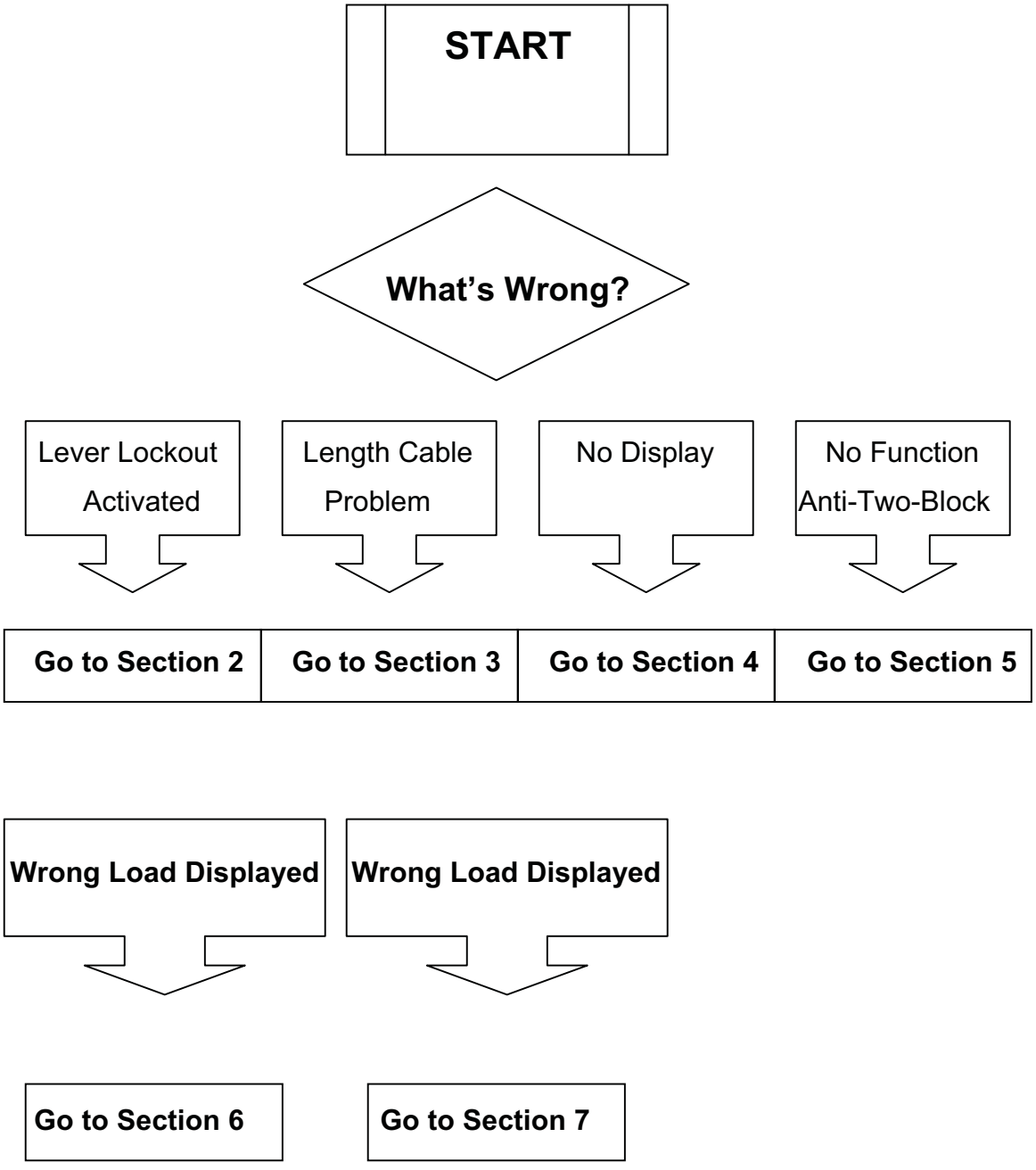
DRAWING 13. Wiring Diagram – Component Connections



SECTION 3. TROUBLESHOOTING FLOW CHARTS

1. GENERAL FLOWCHART

This section explains how to handle a problem that may arise with the PAT Load Moment Indicator System Kruger Mark 4E/2. The procedures are easy to follow and are given in flowcharts on the following pages. Start with the general flowchart below will guide you to one of the other detailed flowcharts shown in this section.



2. LEVER LOCKOUT ACTIVATED

Problem

The lever lockout system of the crane is activated.

Crane movements “hoist up”, “telescope out”, and “boom down” are stopped. Crane is not in overload or two-block condition.

START

Set the override key switch in electronic box into upper position to override LMI.

fixed?

NO

YES

If console display is blank fault is located in power supply, wiring or fuse.

Check lever lockout system in crane.

Does light (6) indicate Anti-Two-Block warning?

NO

YES

If Load Moment Limit Light (5) displays fault is located in LMI, cables, wiring, fuses, or console. Read error code displayed on console display. **Go to Section 4**

Fault in Anti-Two Block system.

3. LENGTH CABLE PROBLEM

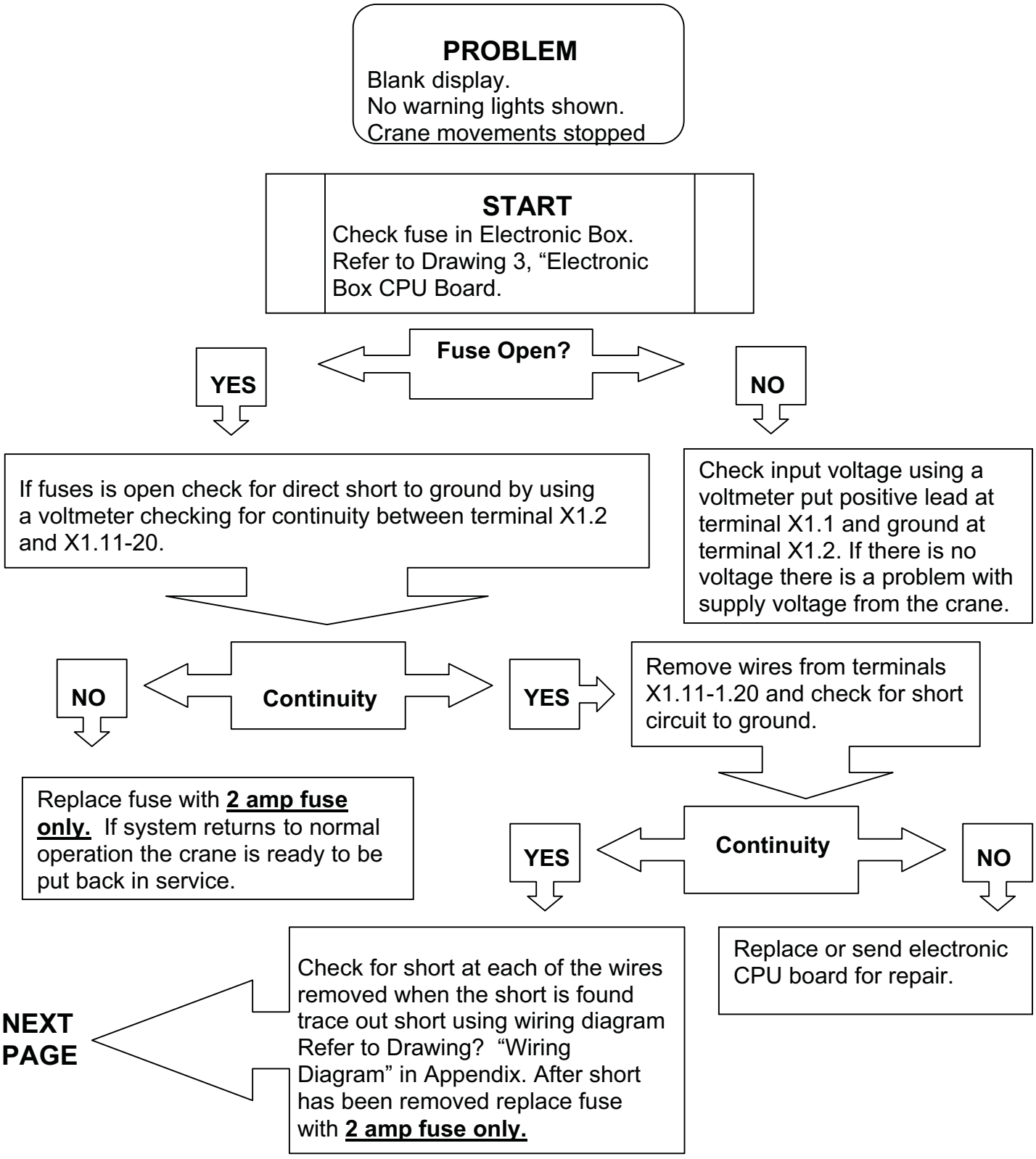
.

PROBLEM

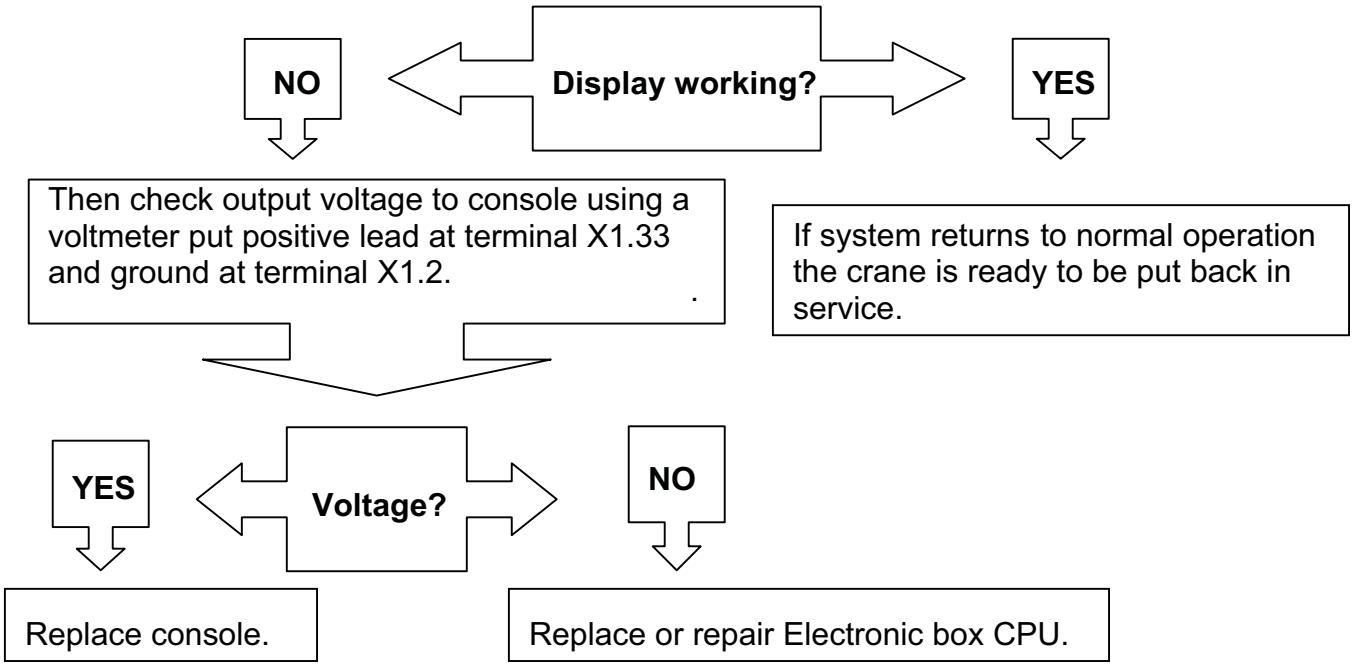
Damaged or broken length cable

STEP	ACTION
1	Turn drum counter-clock wise until drum is fully tensioned.
2	Tighten locking nuts to drum to prevent recoil. Refer to Drawing 1 in Section 11 – Appendix.
3	Take reel cover off and remove screw and cable clamp.
4	Remove wire from slip ring disc cut wire ends off and remove all old length cable from reel.
5	Feed new length cable through drum. Strip wire, separate inner core from shield, insulate shield by using heat shrink or electrical tape, put spade lugs on and wire to slip ring disc terminals 2 and 3. Put cable clamp on and tighten screw to drum.
6	Put silicone around hole where the new length cable is fed through the drum.
7	While holding cable or drum, (Warning! To prevent recoil.) loosen locking nuts and jam the nuts together.
8	Slowly let cable spool on the drum keeping the cable tight together and layering properly. Let cable spool until all tension is off of the cable reel.
9	Re string cable through the roller guides and reconnect at the boom tip.
10	After cable replacement refer to length adjustment procedure to reset length.
11	Put cover on reel and crane is ready to put back in service.

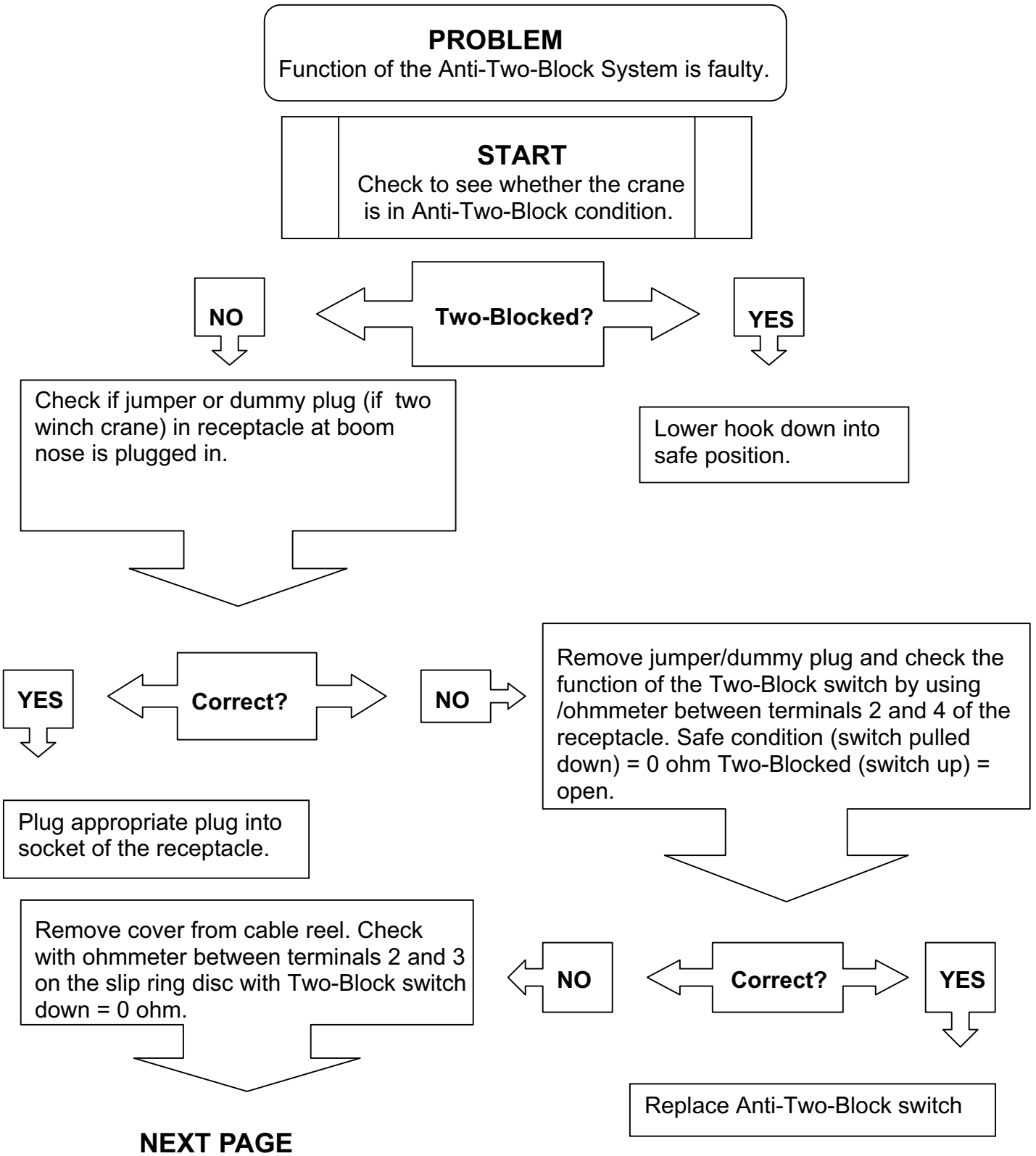
4. BLANK DISPLAY


PROBLEM
Blank display.
No warning lights shown.
Crane movements stopped
START
Check fuse in Electronic Box. Refer to Drawing 3, "Electronic Box CPU Board.
Fuse Open?
YES
NO
If fuses is open check for direct short to ground by using a voltmeter checking for continuity between terminal X1.2 and X1.11-20.
Check input voltage using a voltmeter put positive lead at terminal X1.1 and ground at terminal X1.2. If there is no voltage there is a problem with supply voltage from the crane.
NO
Continuity
YES
Remove wires from terminals X1.11-1.20 and check for short circuit to ground.
Replace fuse with 2 amp fuse only. If system returns to normal operation the crane is ready to be put back in service.
YES
Continuity
NO
Replace or send electronic CPU board for repair.
NEXT PAGE
Check for short at each of the wires removed when the short is found trace out short using wiring diagram Refer to Drawing? "Wiring Diagram" in Appendix. After short has been removed replace fuse with 2 amp fuse only.

PREVIOUS PAGE

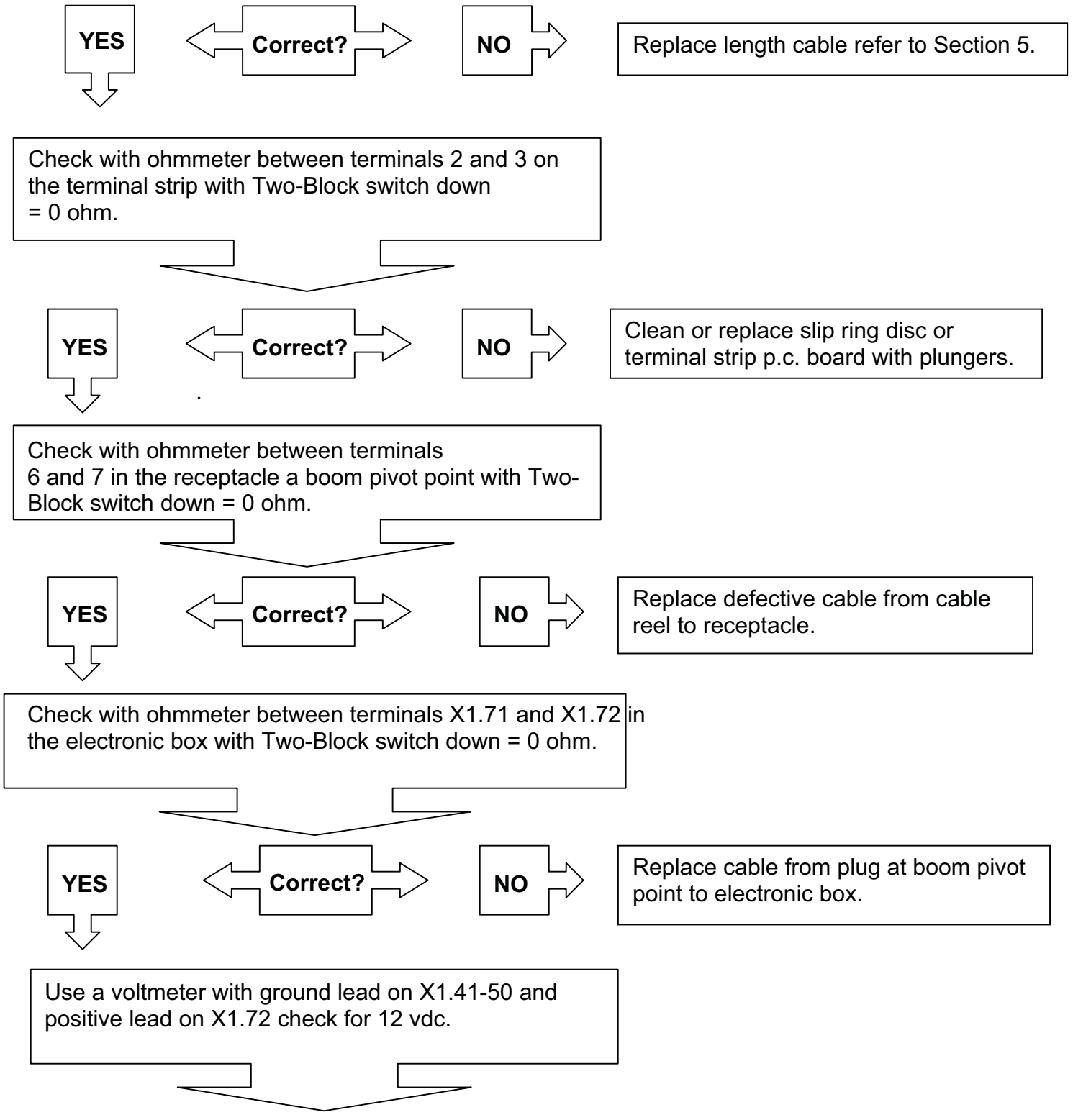

NO
Display working?
YES
Then check output voltage to console using a voltmeter put positive lead at terminal X1.33 and ground at terminal X1.2.
If system returns to normal operation the crane is ready to be put back in service.
YES
Voltage?
NO
Replace console.
Replace or repair Electronic box CPU.

5. ANTI-TWO-BLOCK PROBLEM


PROBLEM
Function of the Anti-Two-Block System is faulty.
START
Check to see whether the crane is in Anti-Two-Block condition.
NO
Two-Blocked?
YES
Check if jumper or dummy plug (if two winch crane) in receptacle at boom nose is plugged in.
Lower hook down into safe position.
YES
Correct?
NO
Remove jumper/dummy plug and check the function of the Two-Block switch by using /ohmmeter between terminals 2 and 4 of the receptacle. Safe condition (switch pulled down) = 0 ohm Two-Blocked (switch up) = open.
Plug appropriate plug into socket of the receptacle.
Remove cover from cable reel. Check with ohmmeter between terminals 2 and 3 on the slip ring disc with Two-Block switch down = 0 ohm.
NO
Correct?
YES
Replace Anti-Two-Block switch

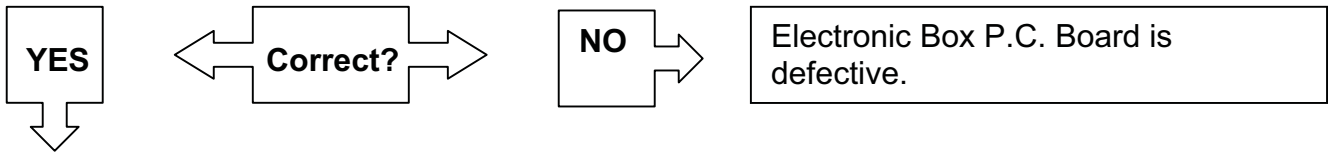
NEXT PAGE

PREVIOUS PAGE


YES
Correct?
NO
Replace length cable refer to Section 5.
Check with ohmmeter between terminals 2 and 3 on the terminal strip with Two-Block switch down = 0 ohm.
YES
Correct?
NO
Clean or replace slip ring disc or terminal strip p.c. board with plungers.
Check with ohmmeter between terminals 6 and 7 in the receptacle a boom pivot point with Two-Block switch down = 0 ohm.
YES
Correct?
NO
Replace defective cable from cable reel to receptacle.
Check with ohmmeter between terminals X1.71 and X1.72 in the electronic box with Two-Block switch down = 0 ohm.
YES
Correct?
NO
Replace cable from plug at boom pivot point to electronic box.
Use a voltmeter with ground lead on X1.41-50 and positive lead on X1.72 check for 12 vdc.

NEXT PAGE

PREVIOUS PAGE



With 12vdc on terminal X1.72 and all checks have been completed you should have 12 vdc on terminal X1.71. If you have the correct voltages the Electronic Box P.C. Board is defective. Send to PAT America, Inc. for repair or replace.

6. LENGTH READING PROBLEM

PROBLEM
Length reading is incorrect. Crane
Is not “out of load chart” condition.

START
Check mechanical adjustment of the length
Potentiometer with boom fully retracted
Indication should match load chart.

`

YES

Correct?

NO

If indication is correct at short boom and has bad indication the problem my be a defective length potentiometer. Refer to Section?

If indication is off by approximately 3 ft. (1m) add or remove 1 rap from cable reel. If this does not repair problem refer to Length Adjustment Procedure section?

7. ANGLE READING PROBLEM

PROBLEM
Angle reading incorrect. Crane is not "out of load chart" condition.

.

START

Check mechanical adjustment of the angle Potentiometer with boom at 0 degrees Indication should match load chart.

Correct?

YES

If indication is correct at 0 degrees and has bad indication the problem my be defective length potentiometer. Refer to Section 7.

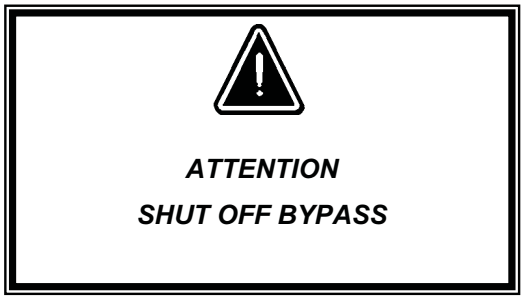
NO

If indication is off check the mechanical adjustment of the angle bracket .Refer to Section 7.

SECTION 4. OPERATOR ERROR CODE TABLE

OPERATION ERRORS

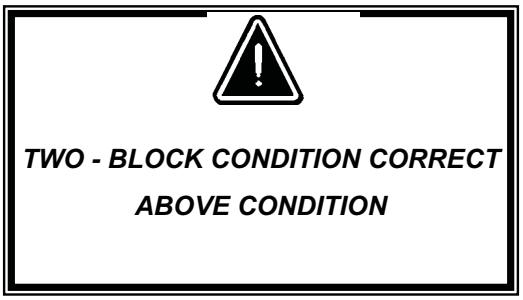
Operation errors are measurement errors, i.e.; the actual radius is lower than in the load chart. The information will be shown on the second line of the display with an error message or description. The error will be automatically reset when user corrects error.



Description of error(s):
The shut-off system is currently by-passed.

Cause(s):
The shut-off contact has been by-passed by the user with the aid of the key-operated switch installed in the junction box.

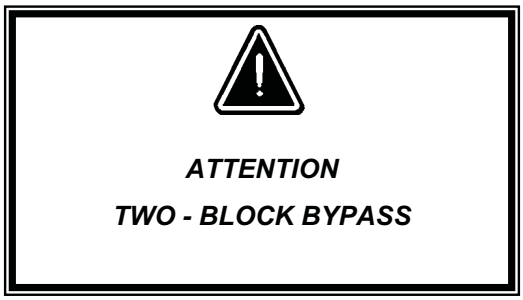
Corrective action:
Cancel the bypass of the shut-off unit, or operate the crane with necessary caution. "Caution!" This condition is not any circumstances the normal operating condition.



Description of error(s):
The Hoist limit switch has come into operation.

Cause(s):
The hook has activated the hoist limit switch, or the cable connection to the vertical lift limit switch is defective.

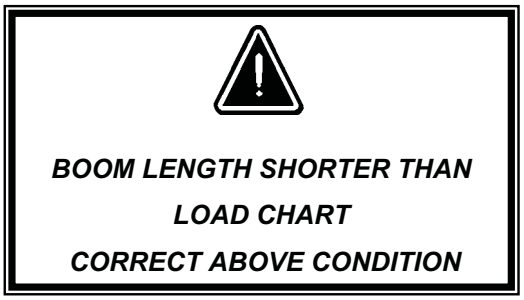
Corrective action:
Lower the load or check the cable connection to the hoist limit switch.



Description of error(s):
The Hoist limit switch is currently by-passed.

Cause(s):
The hoist limit switch has been by-passed with the key-operated switch.

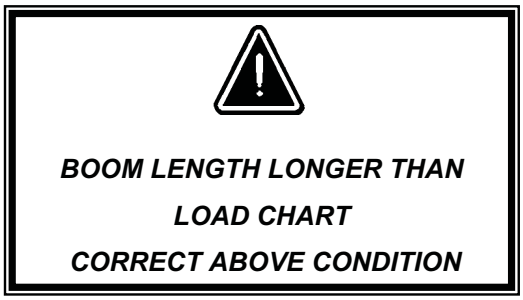
Corrective action:
Release the hoist limit switch or operate the crane with the necessary caution. "Caution: This condition is not under any circumstances the normal operating status".



Description of error(s):
The length of the main boom is shorter than the lowest value in the load chart.

Cause(s):
The boom has been retracted too far. The incorrect set-up condition has been set. The length sensor is not correctly adjusted.

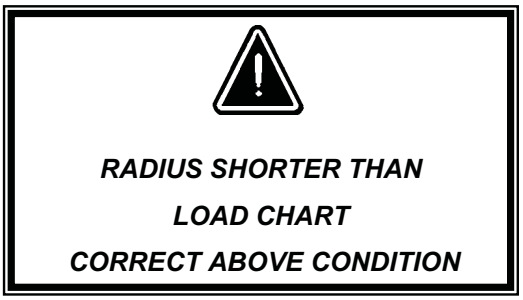
Corrective action:
Extend the boom. Set the correct set-up condition. Adjust the length sensor.



Description of error(s):
The length of the main boom is longer than the lowest value in the Load Chart.

Cause(s):
The boom has been extended too far. The incorrect set-up condition has been set. The length sensor is not correctly adjusted.

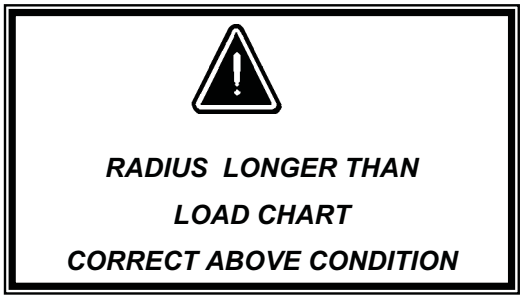
Corrective action:
Retract the boom. Set the correct set-up condition. Adjust the length sensor.



Description of error(s):
The radius of the main boom is shorter than the lowest value in the load chart.

Cause(s):
The boom has been retracted too far. The angle of the boom is to high. The incorrect set-up condition has been set. The length sensor or angle sensor is not correctly adjusted.

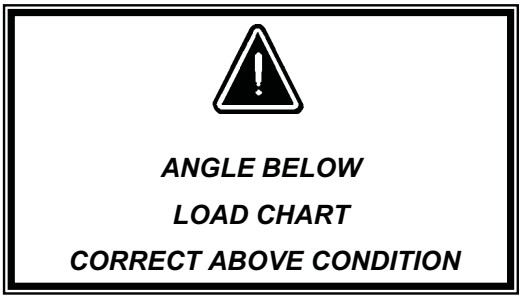
Corrective action:
Extend the boom. Set the correct set-up condition. Adjust the length or angle sensor.



Description of error(s):
The radius of the load is greater than the highest value in the Load Chart.

Cause(s):
The boom has been extended too far. The angle of the boom is to small. The incorrect set-up condition has been set. The length sensor or angle sensor is not correctly adjusted.

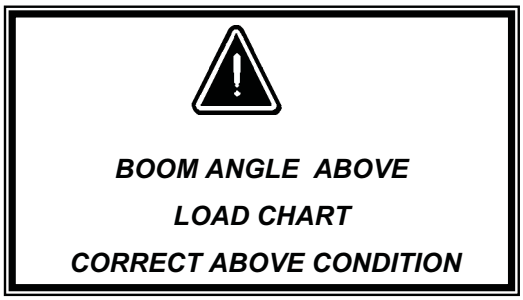
Corrective action:
Retract the boom. Boom up. Set the correct set-up condition. Adjust the length sensor or angle sensor.



Description of error(s):
The angle of the main boom is less than the lowest value in the load chart.

Cause(s):
The angle of the boom is to low. The incorrect set-up condition has been set. The angle sensor is not correctly adjusted.

Corrective action:
Raise the boom. Set the correct set-up condition. Adjust the angle sensor.



Description of error(s):
The angle of the main boom is greater than the highest value in the load chart.

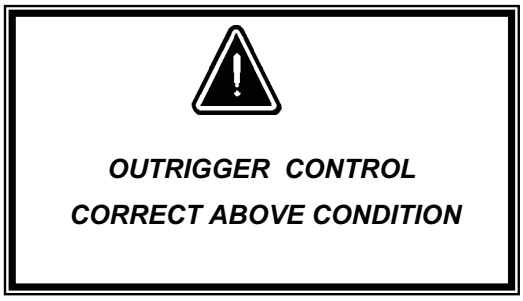
Cause(s):
The angle of the boom is to high. The incorrect set-condition has been set. The angle sensor is not correctly adjusted.

Corrective action:
Lower the boom. Set the correct set-up condition. Adjust the angle sensor.

Description of error(s):
The counterweight currently being used in not correct.

Cause(s):
Wrong counter weight mounted. The set-up condition is expecting a different counter weight. The supply lead for the monitoring switch is defective. The switch input i9s defective.

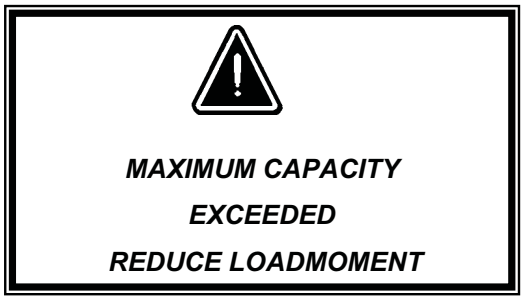
Corrective action:
Mount the correct counter weight. Set the set-up condition that is correct for the counter weight. Check the supply lead for the switch



Description of error(s):
Crane outriggers not properly set.

Cause(s):
Not all outriggers have been correctly extended, or outriggers are not set. The switch supply lead is defective. The switch input is defective.

Corrective action:
Extend or lower outriggers correctly. Check supply lead form the switch. Check the switch input with the help of the Service Mode.



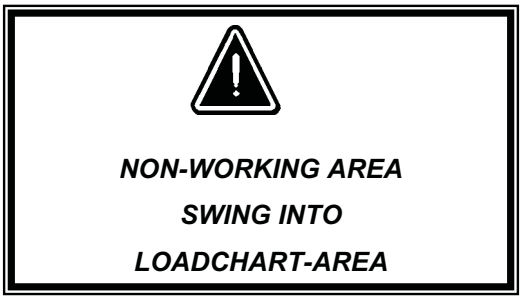
D

Description of error(s):
The current load is greater than the maximum permissible load.

Cause(s):
The current load is too heavy. The radius is too long.

Corrective action:

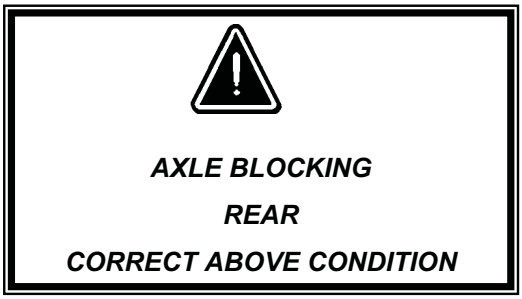
Reduce weight of the current load. Reduce radius (enlarge angle or reduce length).



Description of error(s):
The crane has been swung into a working range that is unacceptable for this set-up condition.

Cause(s):
Crane has been swung into the wrong working range. Incorrect set-up condition has been set. Supply lead for roller switch is defective. Roller switch input is defective.

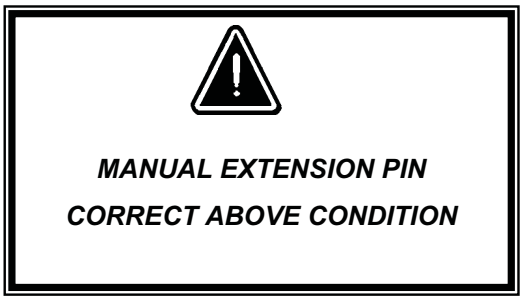
Corrective action:
Slew crane into acceptable working range. Check the set-up condition. Check the supply lead for the roller switch. Check the roller switch input with the help of the Service Mode. The Service Mode is activated by pressing the "GREEN, RED, and PROGRAM" keys simultaneously.



Description of error(s):
Rear axle blocking unit not activated.

Cause(s):
The rear axle has not been blocked. Incorrect set-up condition set. Supply lead for switch is defective. Switch input is defective.

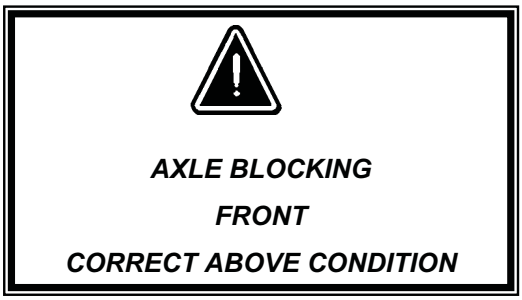
Corrective action:
Block the rear axle. Check the set-up condition. Check the supply lead for the switch. Check the switch input with the help of the Service Mode. The Service Mode is activated by pressing the "GREEN, RED, and PROGRAM" keys simultaneously.



Description of error(s):
Man. Ext. Pin not switched on/off.

Cause(s):
The boom extension has either not been locked or not been unlocked. Incorrect set-up condition set. The supply lead for the monitoring switch is defective. The switch input is defective.

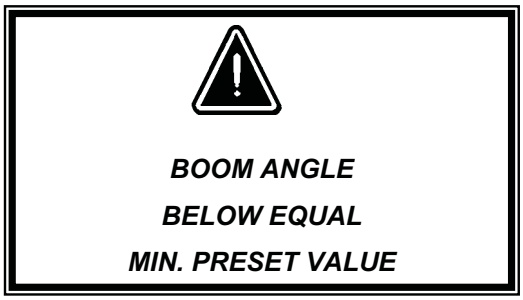
Corrective action:
Lock or unlock the boom extension, as the case may be. Check the set-up condition. Check the supply lead for the switch. Check switch input with the help of the Service Mode. The Service Mode is activated by pressing the "GREEN, RED, and PROGRAM" keys simultaneously,



Description of error(s):
Front axle blocking unit not activated.

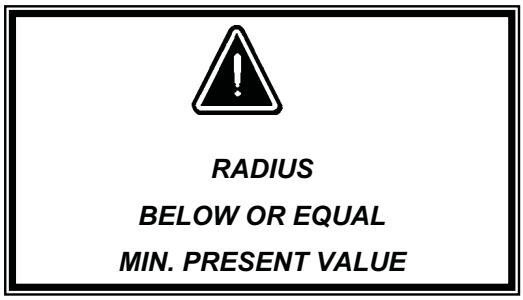
Cause(s):
The front axle has not been blocked. Wrong set-up condition set. Supply lead for the monitoring switch is defective. Switch input is defective.

Corrective action:
Block the front axle. Check the set-up condition. Check supply lead for switch. Check switch input with the help of the Service Mode. The Service Mode is activated by pressing the "GREEN, RED, and PROGRAM" keys simultaneously.



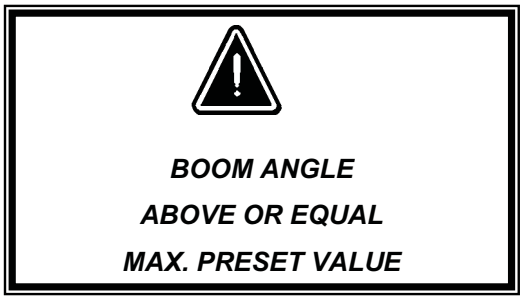
Description of error(s):
The current main boom angle is smaller than or equal to the pre-set minimum value. This is a warning only (no shut-off).

Corrective action:
Enlarge main boom angle.



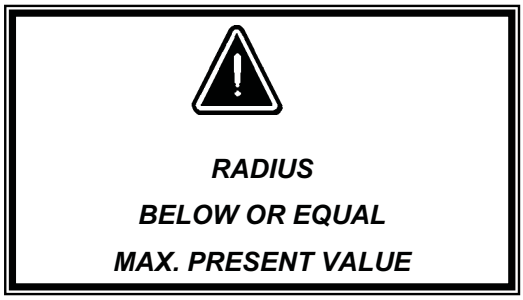
Description of error(s):
The current radius is greater than or equal to the pre-set maximum value. This is a warning only (no shut-off).

Corrective action:
Enlarge main boom angle. Reduce boom length.



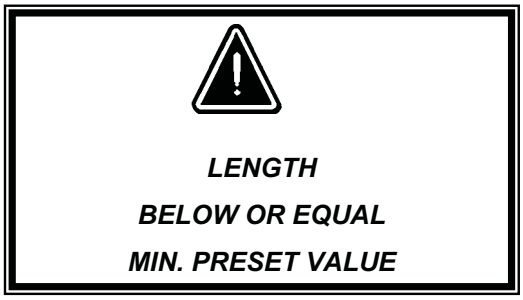
Description of error(s):
The current main boom angle is greater than or equal to the pre-set maximum value. This is a warning only (no shut-off).

Corrective action:
Reduce the angle of the main boom.



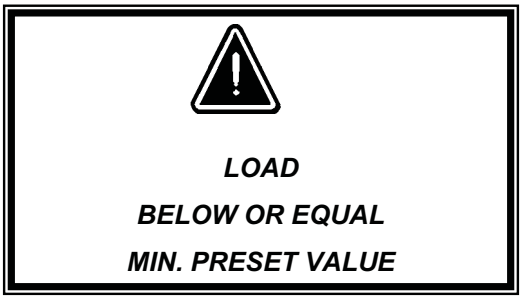
Description of error(s):
The current radius is smaller or equal to the pre-set minimum value. This is a warning only (no shut-off).

Corrective action:
Reduce angle of the main boom. Increase length of boom.



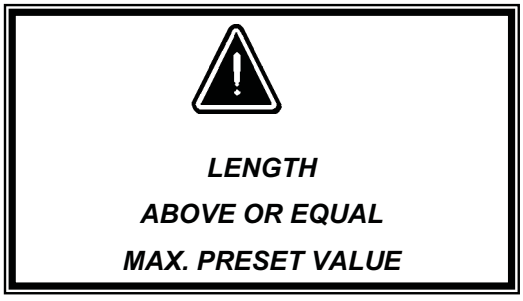
Description of error(s):
The current main boom length is smaller than or equal to the pre-set minimum value. This is a warning only (no shut-off).

Corrective action:
Increase length of main boom.



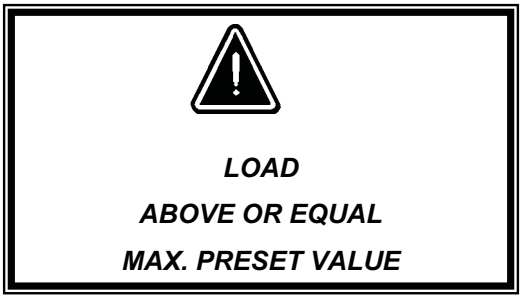
Description of error(s):
The current load is less than or equal to the pre-set minimum value. This is a warning only (no shut-off).

Corrective action:
Increase weight of current load.



Description of error(s):
The current main boom length is greater than or equal to the pre-set maximum value. This is a warning only (no shut-off).

Corrective action:
Reduce length of main boom



Description of error(s):
The current load is greater than or equal to the pre-set maximum value. This is a warning only (no shut-off).

Corrective action:
Reduce the weight of the current load.

Description of error(s:
The crane has been swung into a working range that is unacceptable to a set-up condition on tires. This is a warning only (no shut-off). (Option)

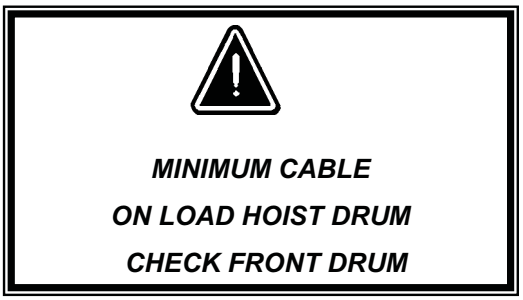
Cause(s):
The crane has been swung into the wrong working range. Incorrect set-up condition set. Supply lead for the roller switch is defective. Input of roller switch is defective.

Corrective action:
Swing the crane into the permissible working range. Check the set-up condition. Check the supply lead for the roller switch.

Description of error(s):
The crane has been swung into a working range that is unacceptable for a supported set-up condition. This is a warning only (no shut-of) (Option).

Cause(s):
Crane has been swung into the wrong working range. Wrong set-up condition set. Supply lead for the monitoring switch is defective. Switch input is defective.

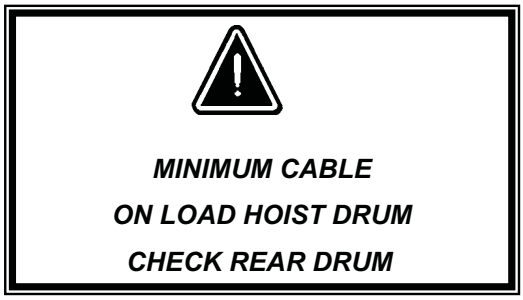
Corrective action:
Slew the crane into the acceptable working range. Check the set-up condition. Check the supply lead for the switch



Description of error(s):
End of hoisting rope on main winch almost reached.

Cause(s):
Hoisting rope on main winch reeled off too far. Supply lead for monitoring switch is defective. Switch input is defective.

Corrective action:
Do not reel off the main winch hoisting rope any further. Check supply lead for the switch. Check input of switch with the help of the Service Mode. The Service Mode is activated by pressing the "GREEN, RED, and PROGRAM" keys simultaneously.



Description of error(s):
End of hoisting rope on the auxiliary winch almost reached.

Cause(s):
Hoisting rope on auxiliary winch reeled off too far. Supply lead for monitoring switch is defective.

Corrective action:
Do not reel off the auxiliary winch hoisting rope any further. Check supply lead for switch. Check input of switch with the help of the Service Mode. The Service Mode is activated by pressing the "GREEN, RED, and PROGRAM" keys simultaneously.

System Errors

CODE NO. 1040

CALL CUSTOMER SERVICE

Description of error(s):
Error of division.

Cause(s):
The system has attempted to divide by zero.

Corrective action:
If the error cannot be eliminated by switching the system on and off, all display values and the set-up condition should be noted down and this information forwarded to Krüger for checking, because an error must have occurred either in the control program or in the the Data-Eproms.

CODE NO. 1042

CALL CUSTOMER SERVICE

Description of error(s):
Incorrect "CHECKSUM" of the control program.

Cause(s):
Loss of data in the Eprom of the control program, or invalid modification of the control program.

Corrective action:
Install new Eprom with valid control program.

CODE NO. 1041

CALL CUSTOMER SERVICE

Description of error(s):
Invalid interrupt vector.

Cause(s):
The system has attempted to execute an interrupt that is not valid.

Corrective action:
If the error cannot be eliminated by switching the system on and off, the system should be returned to Krüger for checking, because an error must have occurred either in the control program or in the hardware.

CODE NO. 1043

CALL CUSTOMER SERVICE

Description of error(s):
No real-time clock.

Cause(s):
A control program requiring a real-time clock has been fitted on a pc board without a real-time clock, or the real-time clock is defective.

Corrective action:
Check the version of the control program and the equipment status on the pc board. If the control program version is in order and a real-time clock(U5) is fitted, it will be necessary to replace the junction box pc board.

This error message is currently deactivated

This error message is currently deactivated.

This error message is currently deactivated

This error message is currently deactivated.

Errors on over ranging

Description of error(s):
Invalid sequence of the main loop.

Cause(s):
Error in the control program.

Corrective action:
If the error cannot be eliminated by switching the system on and off, all display values and the set-up condition should be noted down and this information forwarded to Krüger for checking.

Description of error(s):
Invalid type has been programmed for an analog input.

Cause(s):
An analog input has been programmed in the Data-Eprom that is unknown to the control program.

Corrective action:
Correct and/or replace the Data-Eprom, or replace the control program.

Description of error(s):
Error image not available.

Cause(s):
An error has been initiated that cannot be displayed because the appropriate error image has not been programmed. Possibly an incorrect text version has been programmed in the Data-Eprom.

Corrective action:
All conditions that have led to this error should be noted down and this information

Description of error(s):
Invalid type has been programmed for an analog input.

Cause(s):
An analog input has been programmed in the Data-Eprom that is unknown to the control program.

Corrective action:
Correct and/or replace the Data-Eprom, or replace the control program.

This error message is currently deactivated.

Description of error(s):
The instruction received from the display unit is invalid.

Cause(s):
The control programs in the junction box and display are not compatible.

Corrective action:
Check versions of the control programs for compatibility, and replace one or both.

Description of error(s):
An invalid option has been programmed.

Cause(s):
An option has been programmed in the Data-Eprom "1" that is unknown to the control program.

Corrective action:
Check and correct the Data-Eprom "1", if possible, or check the version of the control program and possibly replace.

Description of error(s):
Invalid type of deflection has been programmed.

Cause(s):
A type of deflection has been programmed in the Data-Eprom "2" that is unknown to the control program.

Corrective action:
Check and possibly correct the Data-Eprom "2", or check version of the control program and replace if necessary.

Description of error(s):
Invalid type of data recorder has been programmed.

Cause(s):
A type of data recorder has been programmed in the Data-Eprom "1" that is unknown to the control program.

Corrective action:
Check and possibly correct the Data-Eprom "1", or check and possibly replace the control program version.

Description of error(s):
Invalid LMI data type has been programmed.

Cause(s):
An LMI data type has been programmed in the Data-Eprom "1" that is unknown to the control program.

Corrective action:
Check and possibly correct the Data-Eprom "1", or check and possibly replace the control program version

Description of error(s):
Invalid present type has been programmed.

Cause(s):
A present type has been programmed in the Data-Eprom "1" that is unknown to the control program.

Corrective action:
Check and possibly correct the Data-Eprom "1", or check and possibly replace the control program version.

Description of error(s):
List of options is full.

Cause(s):
More options have been programmed in the Data-Eprom "1" than the internal list can accept.

Corrective action:
Check the Data-Eprom "1" as to whether all options are needed. If so, a different control program must be used which can manage more options, or the current version of the control program must be revised

Description of error(s):
Absence of an external table with error texts.

Cause(s):
An option has been programmed in the Data-Eprom "1" that requires external error texts and an external table. Such a table has not been found.

Corrective action:
Correct the Data-Eprom "1".

Description of error(s):
Absence of external error texts.

Cause(s):
An option has been programmed in the Data-Eprom "1" that requires external error texts. One of these texts has not been found..

Corrective action:
Correct the Data-Eprom "1".

Programming errors Data-Eprom “1”

Description of error(s):
Identification of the Max. Load Chart is not valid.

Cause(s):
A max. Load Chart has been programmed in the Data-Eprom “1” for the current set-up condition that is unknown to the current control program.

Corrective action:
Correct the Data-Eprom “1” or change the control program.

Description of error(s):
Invalid Eprom identification in Data-Eprom “1”.

Cause(s):
An incorrect Data-Eprom has been inserted in the slot of the Data-Eprom “1”.

Corrective action:
Replace the Data-Eprom “1” with a valid version.

Description of error(s):
Identification of the Set-Up Condition Table is not valid.

Cause(s):
A type has been programmed in the Data-Eprom “1” for the current set-up condition that is unknown to the current control program.

Corrective action:
Correct the Data-Eprom “1” or change the control program.

Description of error(s):
Incorrect “CHECKSUM” in Data-Eprom “1”.

Cause(s):
An incorrect Eprom has been inserted in the slot of Data-Eprom “1”.

Corrective action:
Replace the Data-Eprom “1” with a valid version.

Description of error(s):
Incorrect Country Code programmed.

Cause(s):
Incorrect Country Code has been programmed in the Data-Eprom "1".

Corrective action:
Correct the Data-Eprom "1". Program the valid Country Code, or integrate the respective language module.

This error message is currently deactivated.

Cause(s):
More set-up conditions have been programmed in the Data-Eprom "1" than are set-up condition texts available.

Corrective action:
Correct the Data-Eprom "1".

Description of error(s):
Max. Load Chart not found.

Cause(s):
No max. Load Chart has been programmed in the Data-Eprom "1" for the current set-up condition.

Corrective action:
Correct the Data-Eprom "1".

CODE NO. 10C6

CALL CUSTOMER SERVICE

Description of error(s):
Incorrect number of errors programmed in the Type "0" Max. Load Chart.

Cause(s):
An incorrect number of errors in the current set-up condition has been programmed in the Data-Eprom "1" under the Type "0" Max. Load Chart.

Corrective action:
Correct the Data-Eprom "1".

CODE NO. 10C8

CALL CUSTOMER SERVICE

Description of error(s):
Digital output has not been programmed.

Cause(s):
An option has been programmed that requires a digital output that has not been programmed in the DO_CR_TABLE in the Data-Eprom "1".

Corrective action:
Enter the required output in the DO_CR_TABLE in the Data-Eprom

CODE NO. 10C7

CALL CUSTOMER SERVICE

Description of error(s):
Digital input has not been programmed.

Cause(s):
An option has been programmed that requires a digital input that has not been programmed in the DI_CR_TABLE in the Data-Eprom "1".

Corrective action:
Enter the required input in the DI_CR_TABLE in the Data-Eprom "1".

CODE NO. 10C9

CALL CUSTOMER SERVICE

Description of error(s):
Options list (PRE) is full.

Cause(s):
More options have been programmed in the Data-Eprom "1" than the internal list can accept.

Corrective action:
Check the Data-Eprom "1" as to whether all options are needed. If they are, a different control program must be used that can manage more options, or the current version of the control program must be revised.

Description of error(s):
List of options (POST) is full.

Cause(s):
More options have been programmed in the Data-Eprom "1" than the internal list can accept.

Corrective action:
Check the Data-Eprom "1" as to whether all options are needed. If they are, a different control program must be used that can manage more options, or the current version of the control program must be revised

Description of error(s):
Incorrect number of lengths programmed (Option).

Cause(s):
An incorrect number of lengths has been programmed in the Data-Eprom "1".

Corrective action:
Correct the Data-Eprom "1".

Description of error(s):
List of options is full.

Cause(s):
More options have been programmed in the Data-Eprom "1" than the internal list can accept.

Corrective action:
Check the Data-Eprom "1" as to whether all options are needed. If they are, a different control program must be used that can manage more options, or the current version of the control program must be revised.

Description of error(s):
It is not possible to determine the length (lattice boom).

Cause(s):
There is no Max. Load Chart with a valid length programmed in the Data-Eprom "1".

Corrective action:
Correct the Data-Eprom "1".

Programming errors Data-Eprom "2"

CODE NO. 000F

CALL CUSTOMER SERVICE

Description of error(s):
Identification of the pressure curve is invalid.

Cause(s):
For the current set-up condition, a type of pressure curve has been programmed in the Data-Eprom "2" that is not known to the current control program.

Corrective action:
Correct the Data-Eprom "2" or change the control program.

CODE NO. 1101

CALL CUSTOMER SERVICE

Description of error(s):
Incorrect "CHECKSUM" in the case of Data-Eprom "2".

Cause(s):
An incorrect Eprom has been inserted in the Data-Eprom "2" slot. The contents of the Data-Eprom "2" have been changed with the DSD terminal (deflection, etc.).

Corrective action:
Replace the Data-Eprom "2" with a valid version. Update the "CHECKSUM" with the DSD terminal.

CODE NO. 1100

CALL CUSTOMER SERVICE

Description of error(s):
nvalid EEprom identification in the case of the Data-Eprom "2".
Cause(s):
Incorrect Date-Eprom inserted in the Data-Eprom "2" slot.

Corrective action: ***Replace the Data-Eprom "2" with a valid version.***

CODE NO. 1102

CALL CUSTOMER SERVICE

Description of error(s):
Incorrect size of EEprom (Data-Eprom "2").

Cause(s):
The size of the EEprom (Data=Eprom "2") is incorrectly set in the Data-Eprom "2".

Corrective action:
Correct the Data-Eprom "2".

Description of error(s):
Incorrect number of pressure curves programmed.

Cause(s):
A number of pressure curves have been programmed in the Data-Eprom "2" that do not coincide with the number of programmed set-up conditions.

Corrective action:
Correct the Data-Eprom "2".

Description of error(s):
No set-up condition has been released.

Cause(s):
All set-up conditions blocked via the "Permission" function of the DSD.

Corrective action:
At least one set-up condition must be released.

Description of error(s):
Incorrect length of Deflection Table.

Cause(s):
The number or the structure of the data in the Deflection Table is incorrectly programmed in Data-Eprom "2".

Corrective action:
Correct the Deflection Table in Data-Eprom "2".

Description of error(s):
Pointer to the routine of an external option has not been found.

Cause(s):
The entry with the pointer of the routine of a programmed external option is missing from the Extension Table in the Data-Eprom "2".

Corrective action:
Add the necessary entry to the Extension Table.

Description of error(s):
Pointer to an option-specific data area not found in the Data-Eprom "2".

Cause(s):
The entry for the pointer to the option-specific data of a programmed option is missing from the Extension Table in the Data-Eprom "2".

Corrective action:
Add the necessary entry to the Extension Table, and possibly add the missing data to the Data-Eprom "2".

Description of error(s):
Invalid Length Correction programmed.

Cause(s):
A type of Length Correction has been programmed in the Data-Eprom "2" that is not available.

Corrective action:
Amend the Extension Table to include the necessary entry, and possibly the Data-Eprom "2" to include the missing data.

Description of error(s):
Pointer to an option-specific data area not found in the Data-Eprom "2".

Cause(s):
The entry for the pointer to the option-specific data of a programmed option is missing from the Extension Table in the Data-Eprom "2".

Corrective action:
Add the necessary entry to the Extension Table, and possibly add the missing data to the Data-Eprom "2".

Description of error(s):
Invalid Length Correction programmed.

Cause(s):
A type of Length Correction has been programmed in the Data-Eprom "2" that is not available.

Corrective action:
Amend the Extension Table to include the necessary entry, and possibly the Data-Eprom "2" to include the missing data.

Description of error(s):
Invalid memory size of the data recorder RAM.

Cause(s):
The length programmed in Data-Eprom "2" is invalid.

Corrective action:
Enter allowable size for the data recorder RAM in the Data-Eprom "2".

This error message is currently deactivated.

User errors

CODE NO. 1140

CALL CUSTOMER SERVICE

Description of error(s):
Control program has been changed.

Cause(s):
The Eprom with the control program has been changed since the last time the system was switched off.

Corrective action:
The new control program can be legalized with the DSD function "CHECKSUM".

CODE NO. 1142

CALL CUSTOMER SERVICE

Description of error(s):
The Data-Eprom "2" has been changed.

Cause(s):
The Data-Eprom "2" has been changed since the system was last switched off.

Corrective action:
The new Data-Eprom can be legalized with the DSD function "CHECKSUM".

CODE NO. 1141

CALL CUSTOMER SERVICE

Description of error(s):
The Data-Eprom "1" has been changed.

Cause(s):
The Data-Eprom "1" has been changed since the system was last switched off.

Corrective action:
The new Data-Eprom can be legalized with the DSD function "CHECKSUM".

CODE NO. 1143

CALL CUSTOMER SERVICE

Description of error(s):
The current set-up condition is blocked.

Cause(s):
An attempt has been made to block the active set-up condition with the "DSD".

Corrective action:
It is not possible to block an active set-up condition, so a new set-up condition must be selected first in order to block the old one.

CODE NO. 1144

CALL CUSTOMER SERVICE

Description of error(s):
Data record of the data recorder not available.

Cause(s):
Loss of data in the RAM.

Corrective action:
Reset the data recorder.

Communication errors

CODE NO. 2000-2007

CALL CUSTOMER SERVICE

Description of error(s):
An error has occurred during transmission of data to the display.

Corrective action:
Check cable connection to the display unit.

CODE NO. 2010-2017

CALL CUSTOMER SERVICE

Description of error(s):
Fault in the shut-off circuit.

Cause(s):
Fault on the junction box pc board.

Corrective action:
Replace junction box board

Hardware faults

CODE NO. F000

CALL CUSTOMER SERVICE

Description of error(s):
12 V DC voltage fault.

Cause(s):
The 12 V DC supply voltage has dropped below 12 V DC-20%.

Corrective action:
On 12 V DC systems, check the input voltage with a multimeter. If the voltage is higher than 12 V DC-20%, the voltage waveshape can still be checked with an oscilloscope for voltage dips. On 24 V DC systems, check the input voltage with a multimeter. If the voltage is higher than 24 V DC-20%, check the 12 V DC with a multimeter at terminal 11-20. If this voltage is less than 12 V DC, all loads connected to 12 V DC must be checked for short-circuits.

CODE NO. F001

CALL CUSTOMER SERVICE

Description of error(s):
12 V DC voltage fault.

Cause(s):
The 12 V DC supply voltage has dropped below 12 V DC-20%.

Corrective action:
On 12 V DC systems, check the input voltage with a multimeter. If the voltage is higher than 12 V DC-20%, the voltage waveshape can still be checked with an oscilloscope for voltage dips. On 24 V DC systems, check the input voltage with a multimeter. If the voltage is higher than 24 V DC-20%, check the 12 V DC with a multimeter at terminal 11-20. If this voltage is less than 12 V DC, all loads connected to 12 V DC must be checked for short-circuits.

CODE NO. F002

CALL CUSTOMER SERVICE

Description of error(s):
ADC Timeout.

Cause(s):
Malfunction of the A/D converter.

Corrective action:
Replace junction box board.

CODE NO. F040-F042

CALL CUSTOMER SERVICE

Description of error(s):
Error when writing into the Data-Eprom "2" (EEprom).

Cause(s):
Data-Eprom "2" is defective.

Corrective action:
Replace the Data-Eprom "2".

Description of error(s):
Error during access to the serial EEprom.

Cause(s):
Serial EEprom or junction box board is defective.

Corrective action:
Replace junction box board.

Description of error(s):
Timer List full.

Cause(s):
The control program has attempted to activate more timers than are listed.

Corrective action:
If the error cannot be eliminated by switching the system on and off, all display values and the set-up condition should be noted down and this information sent to Krüger for checking, since there is an error either in the control program or in the Data-Eproms.

Description of error(s):
System Timer not functioning

Cause(s):
Hardware is defective.

Corrective action:
Replace junction box board.

Description of error(s):
Extended Timer List full.

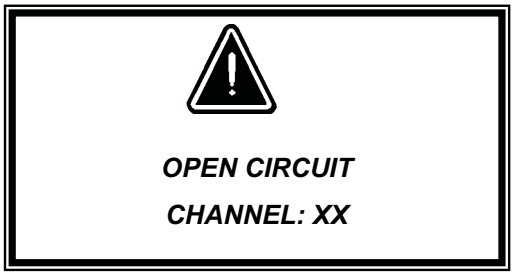
Cause(s):
Within an external option, the control program has attempted to activate more timers than are listed.

Corrective action:
If the error cannot be eliminated by switching the system on and off, all display values and the set-up condition should be noted down and this information sent to Krüger for checking, since there is an error either in the control program or in the Data-Eproms.

Description of error(s):
Extended Timer List full (OPTION).

Cause(s):
Within an external option, the control program has attempted to activate more timers than are listed.

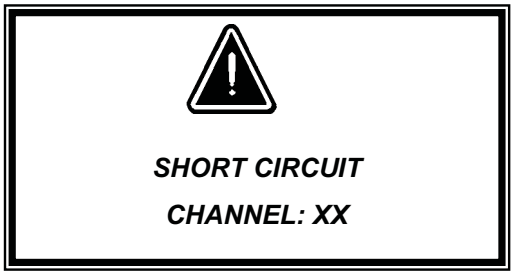
Corrective action:
If the error cannot be eliminated by switching the system on and off, all display values and the set-up condition should be noted down and this information sent to Krüger for checking, since there is an error either in the control program or in the Data-Eproms.



Description of error(s):
Cable break at analog input "xx".

Cause(s):
The analog input "xx" has a break (analog inout open) or the voltage has dropped below the value programmed in Data-Eprom "1" in the ADC_MIMA_TABLE.

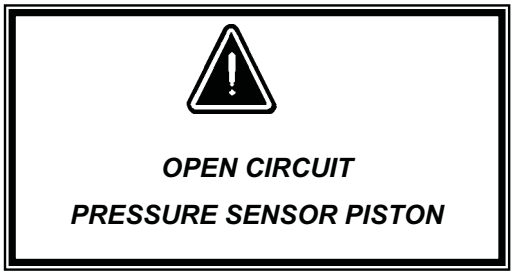
Corrective action:
Check cable connection of the analog input "xx".



Description of error(s):
Cable short-circuit at analog input "xx".

Cause(s):
The analog input "xx" has a short-circuit, or the voltage has dropped below the value programmed in Data-Eprom "1" in the ADC_MIMA_TABLE.

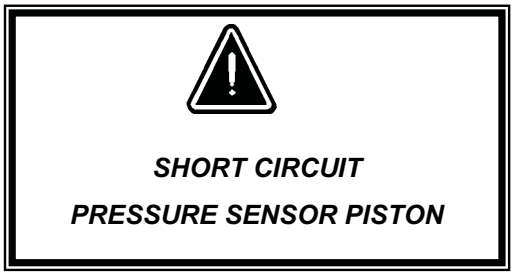
Corrective action:
Check cable connection of the analog input "xx". T



Description of error(s):
Cable short at the analog input of the pressure.

Cause(s):
The analog input, which has been programmed in the Data-Eprom "1" in the ADC_MIMA_TABLE for the pressure sensor, has a short circuit, or the voltage has dropped below the value programmed in the ADC_MIMA_TABLE in Data-Eprom "1".

Corrective action:
Check the cable connection of the pressure sensor.



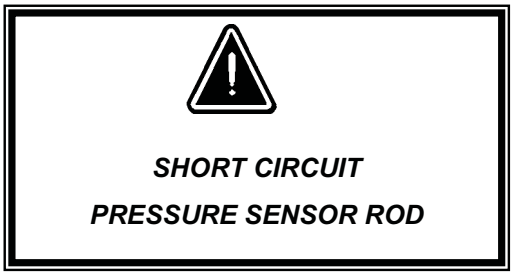
SHORT CIRCUIT

PRESSURE SENSOR PISTON

Description of error(s):
Cable short at the analog input of the pressure sensor.

Cause(s):
The analog input, which has been programmed in the Data-Eprom "1" in the ADC_CR_TAB for the pressure sensor, has a break (analog input open), or the voltage has dropped below the value programmed in the ADC_MIMA_TABLE in Data-Eprom "1".

Corrective action:
Check the cable connection of the pressure sensor.



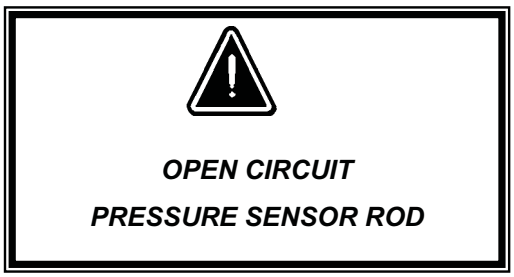
SHORT CIRCUIT

PRESSURE SENSOR ROD

Description of error(s):
Cable short-circuit at the analog input of the pressure sensor for the rodside of the cylinder.

Cause(s):
The analog input, which was programmed in the Data-Eprom "1" in the ADC_CR_TAB for the pressure sensor, has a short-circuit, or the voltage has dropped below the value programmed in the ADC_MIMA_TABLE in Data-Epromo

Corrective action:
Check the cable connection of the pressure sensor.



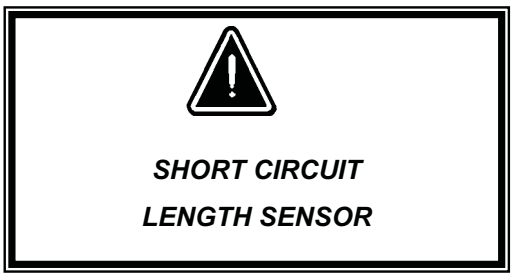
OPEN CIRCUIT

PRESSURE SENSOR ROD

Description of error(s):
Cable break at the analog input of the pressure sensor for the rodside of the cylinder.

Cause(s):
The analog input, which was programmed in the Data-Eprom "1" in the ADC_CR_TAB for the pressure sensor of the rodside of the derrick cylinder, has a break (analog input open), or the voltage has dropped below the value programmed in the ADC_MIMA_TABLE in Data-Eprom "1".

Corrective action:
Check the cable connection of the pressure sensor for the rodside of the cylinder.



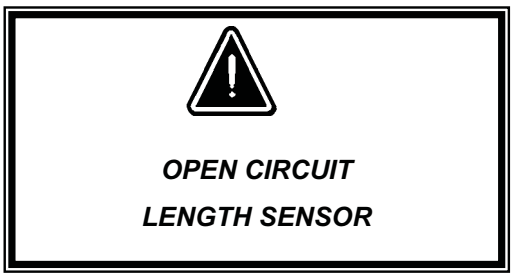
SHORT CIRCUIT

LENGTH SENSOR

Description of error(s):
Cable short-circuit at the analog input of the length sensor .

Cause(s):
The analog input, which was programmed in the Data-Eprom "1" in the ADC_CR_TAB for the length sensor has a short circuit, or the voltage has dropped below the value programmed in the ADC_MIMA_TABLE in Data-Eprom "1".

Corrective action:
Check the cable connection of the length sensor "1".



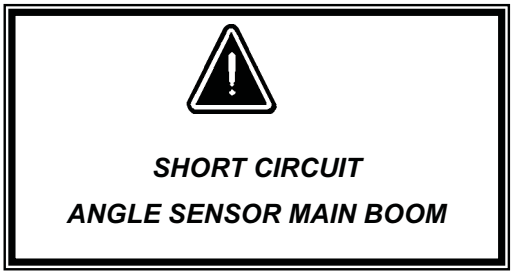
OPEN CIRCUIT

LENGTH SENSOR

Description of error(s):
Cable break at the analog input of the length sensor.

Cause(s):
The analog input, which was programmed in the Data-Eprom "1" in the ADC_CR_TAB for the length sensor, has a break (analog input open), or the voltage has dropped below the value programmed in the ADC_MIMA_TABLE in Data-Eprom "1".

Corrective action:
Check the cable connection of the length sensor .



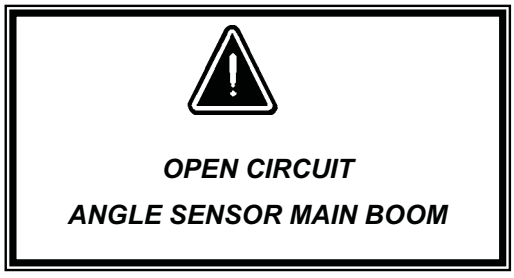
SHORT CIRCUIT

ANGLE SENSOR MAIN BOOM

Description of error(s):
Cable short-circuit at the analog input of the angle sensor for the main boom.

Cause(s):
The analog input, which was programmed in the Data-Eprom "1" in the ADC_CR_TAB for the angle sensor of the main boom, has a short circuit, or the voltage has dropped below the value programmed in the ADC_MIMA_TABLE in Data-Eprom "1".

Corrective action:
Check the cable connection of the angle sensor for the main boom.



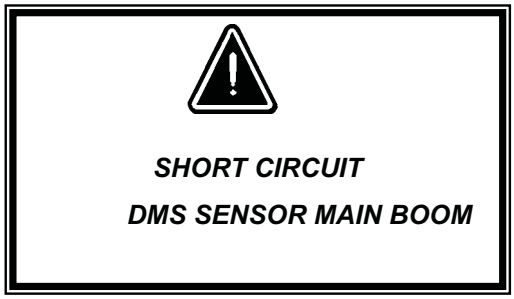
OPEN CIRCUIT

ANGLE SENSOR MAIN BOOM

Description of error(s):
Cable break at the analog input of the angle sensor for the main boom.

Cause(s):
The analog input, which was programmed in the Data-Eprom "1" in the ADC_CR_TAB for the angle sensor of the main boom, has a break (analog input open), or the voltage has exceeded the value programmed in the ADC_MIMA_TABLE in Data-Eprom "1".

Corrective action:
Check the cable connection of the angle sensor for the main boom.



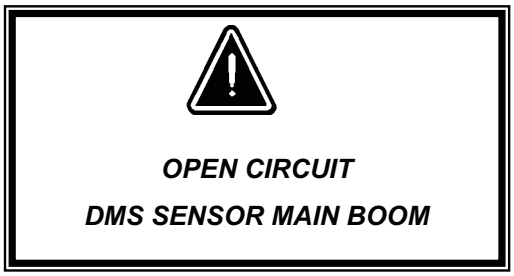
SHORT CIRCUIT

DMS SENSOR MAIN BOOM

Description of error(s):
Cable short-circuit at the analog input of the strain gauge (DMS) for the main boom.

Cause(s):
The analog input, which was programmed in the Data-Eprom "1" in the ADC_CR_TAB for the angle sensor of the strain gauge (DMS) for the main boom, has a short circuit, or the voltage has dropped below the value programmed in the ADC_MIMA_TABLE in Data-Eprom "1".

Corrective action:
Check the cable connection of the strain gauge (DMS) for the main boom.



OPEN CIRCUIT

DMS SENSOR MAIN BOOM

Description of error(s):
Cable break at the analog input of the strain gauge (DMS) for the main boom.

Cause(s):
The analog input, which was programmed in the Data-Eprom "1" in the ADC_CR_TAB for the strain gauge (DMS) of the main boom, has a break (analog input open), or the voltage has exceeded the value programmed in the ADC_MIMA_TABLE in Data-Eprom "1".

Corrective action:
Check the cable connection of the strain gauge (DMS) for the main boom.

Error messages display unit

Description of error(s):
Invalid sequence of the main loop.

Cause(s):
Error in the control program.

Corrective action:
If the error cannot be eliminated by switching the system on and off, all display values and the set-up condition should be noted down and the information sent Krüger for checking, because an error must have occurred either in the control program or in the Data-Eproms.

Description of error(s):
Invalid interrupt vector.

Cause(s):
The system has attempted to execute an interrupt that was not allowed.

Corrective action:
If the error cannot be eliminated by switching the system on and off, all display values and the set-up condition should be noted down and the information sent to Krüger for checking.

Description of error(s):
Error of division.

Cause(s):
The system has attempted to divide by zero.

Corrective action:
If the error cannot be eliminated by switching the system on and off, all display values and the set-up condition should be noted down and the information sent to Krüger for checking, because an error must have occurred either in the control program or in the Data-Eproms.

Description of error(s):
Error of division.

Cause(s):
The system has attempted to divide by zero.

Corrective action:
If the error cannot be eliminated by switching the system on and off, all display values and the set-up condition should be noted down and the information sent to Krüger for checking, because an error must have occurred either in the control program or in the Data-Eproms.

Description of error(s):
The junction box has requested a display image which is unknown to the display program.

Cause(s):
The control programs in the junction box and the display are not compatible.

Corrective action:
Check versions of the control programs for compatibility, and replace one or both.

Description of error(s):
The received set-up condition text is too long.

Cause(s):
A set-up condition text programmed in the Data-Eprom "1" of the junction box is too long.

Corrective action:
Correct the Data-Eprom "1" in the junction box.

Description of error(s):
The received present text is too long.

Cause(s):
A present text programmed in the Data-Eprom "1" of the junction box is too long.

Corrective action:
Correct the Data-Eprom "1" in the junction box.

This error message is currently deactivated.

Description of error(s):
Junction box not transmitting any data.

Cause(s):
During normal LMI operation, the junction box has not set any data within the preset time.

Corrective action:
Check cable connection between junction box and display. If the error cannot be remedied by switching the system on an doff, all display values and set-up condition should be noted down and the information sent to Krüger for checking.

Description of error(s):
Invalid Telecontrol Code received.

Cause(s):
The control programs in the junction box and the display are not compatible.

Corrective action:
Check versions of the control programs for compatibility, and replace one or both.

Description of error(s):
Incorrect "CHECKSUM" of the control program.

Cause(s):
Loss of data in the Eprom of the control program, o inadmissible modification of the control program.

Corrective action:
Install new Eprom with valid control program.

Description of error(s):
Invalid LMI data received.

Cause(s):
The control programs in the junction box and the display are not compatible.

Corrective action:
Check versions of the control programs for compatibility, and replace one or both.

Description of error(s):
Too many entries in the LMI Image List.

Cause(s):
Too many LMI images programmed in the Data-Eprom "1" of the junction box, or the list is too short.

Corrective action:
Correct the Data-Eprom "1" of the junction box, or possibly use a control program with a longer list.

Description of error(s):
Too many entries in the List of Options Images.

Cause(s):
Too many options images programmed.

Corrective action:
Correct the Data-Eprom "1" of the junction box, or possibly use a control program with a longer list.

Communication errors

CODE NO. 2100-2107
CALL CUSTOMER SERVICE

Description of error(s):
An error has occurred during transmission of data to the display.

Corrective action:
Check cable connection to the display unit.

CODE NO. 2110-2117
CALL CUSTOMER SERVICE

Description of error(s):
An error has occurred during reception of data to the display.

Corrective action:
Check cable connection to the display unit.

Hardware faults

CODE NO. E000
CALL CUSTOMER SERVICE

Description of error(s):
System timer not functioning.

Cause(s):
Defective hardware.

Corrective action:
Replace display pc board.

CODE NO. E000
CALL CUSTOMER SERVICE

Description of error(s):
Timer list is full.

Cause(s):
The control program has attempted to activate more timers than are listed.

Corrective action:
If the error/fault cannot be remedied by switching the system on and off, all display values and the set-up condition should be noted down and the information sent to Kruüger for checking, since an error has occurred either in the control program or in the Data-Eproms.

SECTION 5. ANGLE TRANSDUCER REPLACEMENT AND ADJUSTMENT

This section will provide the user with step-by-step procedures to replace the Angle Transducers and to perform the necessary adjustments on these components Please read through the replacement and/or adjustment procedures before you attempt to replace a component or make an adjustment. If a component replacement is necessary order the component from PAT America, Inc. before removing the component. Include crane model and serial number when ordering to allow PAT America technician's to test the potentiometer to ensure operation over the voltage range of the original system installation.

Angle Transducer Replacement

Tools required:

Soldering Iron

8mm Box wrench

Needle nose pliers

Digital Level or Magnetic base angle protractor

Small flat blade screwdriver

Procedure

1. Lower the boom to an 0 degree angle to access the transducer mounted on the boom base section.
2. Turn off power to the Load Moment System.
3. Remove cable reel cover. Store the 4 screws, washers and clamps in a safe place.
4. Use the soldering iron and needle nose pliers to remove the three (3) wires from the angle potentiometer. WARNING! Before removing wires make a diagram of there location.
5. With box end wrench loosen the nut and remove the pendulum from the angle potentiometer.
6. Remove the three new angle potentiometer clamps and install the new angle potentiometer.
7. Use the soldering iron to connect the wires to the angle potentiometer using the diagram made in step 4.
8. Supply power to the Load Moment System.
9. Adjust stem of the potentiometer to indicate 0 degrees then put pendulum on and tighten nut using 8mm wrench.
10. After putting pendulum on recheck for 0 degree indication if panel agrees tighten all nuts and screws.
11. If the angle displayed on the panel does NOT AGREE with the actual angle shown on the angle protractor proceed as follows:
12. Loosen, but DO NOT remove the three (3) screws holding the angle potentiometer clamps. SLOWLY rotate the Potentiometer until the angle indication on the panel is the same as the actual angle 0 degrees with boom level.
13. Tighten the 3 screws that hold the angle potentiometer clamps.
14. Boom up to the maximum angle possible. Be sure to verify the actual boom angle using the Magnetic base angle protractor or digital level.
15. If the angle displayed on the panel AGREES with the actual angle shown on the angle protractor or digital level go to step 15.
16. If the Angle displayed on the panel DOES NOT agree with the actual angle shown on theangle protractor or digital level proceed to angle adjustment procedure.
17. Lower boom and reinstall the cable reel cover.

The Angle Transducer has been replaced and adjusted. The machine can be put back into service.

ANGLE TRANSDUCER ADJUSTMENT

Tools required:

Small flat blade screwdriver

Digital Level or Magnetic base angle protractor

Procedure

Adjust angle:

a. Set angle transducer as shown in drawing 2
b. Plug Psion into Electronic box and power the system.
c. When the **NORM** menu title is blinking then push EXE (lowest most right button).
d. Push left or right button until **ANGLE** menu title is blinking then push EXE button.
e. Push left or right button until **MINIMUM** menu title is blinking then push EXE button.
f. Enter in the minimum value of boom angle normally 0 degrees verifying angle using angle finder, magnetic base protractor or digital level.
g. Boom to the highest possible boom angle staying within load chart value.
h. Push left or right button until **MAXIMUM** menu title is blinking then push EXE button.
i. Enter in the maximum angle, verifying angle using angle finder, magnetic base protractor or digital level.
j. Push left or right button until **ADJUST** menu title is blinking then push EXE button.
k. Push left or right button until **EXIT** menu title is blinking then push EXE button.

The Angle Transducer has been replaced and adjusted. The machine can be put back into service

SECTION 6. LENGTH TRANSDUCER REPLACEMENT AND ADJUSTMENT

Length Transducer Replacement

Tools required:

1.5mm Allen wrench

13mm Open end wrench

Medium flat blade screwdriver

Needle nose pliers

Digital Volt-Ohm meter

Procedure

1. Locate machine in an area that will allow you to safely extend the boom to it's full extension (Powered sections plus manual section).
2. Fully retract the boom and lower to an angle that will provide you with access to the cable reel mounted on the boom base section.
3. Turn off power to the Load Moment System.
4. Remove cable reel cover. Store the 4 screws, washers and clamps in a safe place.
5. Rotate the arm attached to the length potentiometer until the setscrew is accessible. Loosen, but DO NOT remove the setscrew.
6. Rotate the arm until the second setscrew is accessible. Loosen, but DO NOT remove the setscrew.
7. Remove the arm from the Length potentiometer and store in a safe location.
8. Remove the nylon gear from the length potentiometer shaft.
9. Use the 13mm wrench to remove the length potentiometer from the mounting bracket.
10. Use the soldering iron and needle nose pliers to remove the three (3) wires from the angle potentiometer. WARNING! Before removing wires make a diagram of there location.
11. Install the new length potentiometer in the mounting bracket. Tighten using 13 mm wrench.
12. Install the large nylon gear on the potentiometer shaft. Be sure that the brass spacer is facing toward the boom.
13. Install the lever arm on the potentiometer shaft and tighten both setscrews.
14. Use the soldering iron to connect the wires to the angle potentiometer using the diagram made in step 4.
15. Set VOLT-OHM meter to read OHMS. Place one probe on terminal #1 of the terminal strip and the other probe on terminal #2. Turn the lever arm until the meter indicates approximately 95 OHMS. Remove the meter from the circuit.
16. Supply power to the Load Moment System.
17. Follow system start up procedure to put the display panel in the normal operating mode.
18. With all boom sections FULLY RETRACTED rotate lever arm on the length potentiometeruntil the length displayed on the panel indicates the shortest boom length shown on the crane capacity chart.
19. FULLY EXTEND boom sections. Panel should display the maximum extended boom length of the load chart.
20. If the length displayed on the panel AGREES the machine can be put back in service.
21. If the length displayed DOES NOT AGREE go to LENGTH TRANSDUCER ADJUSTMENT.

Length Transducer Adjustment

Tools required:

Medium screw driver

Procedure

1. Locate machine in an area that will allow you to safely extend the boom to it's full extension.
2. Fully retract the boom and lower to an angle that will provide you with access to the cable reel mounted on the boom base section. Open reel and adjust length voltage to 1.000 vdc measuring from terminal #1 to terminal #2 on the terminal strip in the cable reel
3. Push the DOWN/ANGLE-LENGTH" (7) or UP/TARE" (9) button until NORM menu title is blinking then push the PROGRAM/BUZZER (8) button.
4. Push the DOWN/ANGLE-LENGTH" (7) or UP/TARE" (9) button until LENGTH menu title is blinking then push the PROGRAM/BUZZER (8) button.
5. Verify boom is at fully retracted.
6. Push the DOWN/ANGLE-LENGTH" (7) or UP/TARE" (9) button until MINIMUM menu title is blinking then push the PROGRAM/BUZZER (8) button.
7. Push the PROGRAM/BUZZER (8) button until all digits have been verified with the proper value, which will be minimum boom length of the load chart.
8. Telescope the boom all the way out.
9. Push the DOWN/ANGLE-LENGTH" (7) or UP/TARE" (9) button until MAXIMUM menu title is blinking then push the PROGRAM/BUZZER (8) button.
10. Push the PROGRAM/BUZZER (8) button until all digits have been verified with the proper value, which will be maximum boom length of the load chart
11. Push the DOWN/ANGLE-LENGTH" (7) or UP/TARE" (9) button until ADJUST menu title is blinking then push the PROGRAM/BUZZER (8) button.
12. Push the DOWN/ANGLE-LENGTH" (7) or UP/TARE" (9) button until EXIT menu title is blinking then push the PROGRAM/BUZZER (8) button.
13. Push the DOWN/ANGLE-LENGTH" (7) button to EXIT then the PROGRAM/BUZZER (8) button until you get to the Program menu and enter the working display. Verify length values to load chart lengths.

The Length Transducer has been adjusted. The machine can be put back in service.

7. LENGTH CABLE REPLACEMENT

PROBLEM: Damaged or broken length cable.

Replace length cable using the following procedure:

1. Cut old cable at cable drum
2. Disconnect damaged length cable from junction box at the boom nose.
3. Open cable reel cover and disconnect wiring from connection block. Pull 7 conductor cable out of strain relief.
4. Remove cable reel from mounting brackets.
5. Remove damaged length cable, which is mounted to the slip rings in the cable reel, from slip ring connection. Refer to Drawing 1 in Section 11 – Drawings
6. On the back side of the cable reel, open the strain relief attached to the axle in the center of the drum. Pull existing length cable out of the cable reel.
7. Pull new length cable through the hole, pipe and strain relief and push it through the axle of the reeling drum. Tighten strain relief to ensure sealing.
8. Reconnect the length cable to the slip ring. Refer to Drawing 1 in Section 11 - Drawings.
9. Remount cable reel to the boom.
10. Turn reeling drum clockwise to spool the new cable neatly onto the drum.
11. Set preload on cable reel by turning the drum counter-clockwise 5 to 8 turns.
12. Wrap the new length cable around the boom tip anchor pin (4 or 5 wraps) and secure with tie wraps. Leave enough length cable to connect into the boom tip junction box.
13. Connect the length cable into the boom tip junction box. Refer to Drawing 1 in Section 11 - Drawings.
14. Reset length potentiometer in length angle transducer (screw is located in center of white gear); with boom fully retracted, turn potentiometer carefully counter-clockwise until it stops. Recheck length and angle display. Refer to Drawing 6 in Section 11 – Drawing.

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